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Prevalence And Risk Factors Associated with Musculoskeletal Discomfort among Vegetable Street Vendors

Aishwarya M. Rathod[1*], Pratik Meshram[2], Virendra Meshram[3]

[1]Intern at SVSS Latur college of Physiotherapy, [2]Assistant professor of Department of Neurophysiotherapy, At SVSS Latur college of physiotherapy, [3]Principal of SVSS Latur college of physiotherapy

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ABSTRACT

Background: The common health problem among workers is musculoskeletal disorders due to intensive manual work(1). Pain, stiffness, swelling are the symptoms of musculoskeletal disorders(1)..High energy expenditures, heavy spinal loading during lifting and carrying, highly repetitive movements and crawling, stooping and other difficult work postures are require at field work and for material handling(14).

Aim: To determine the prevalence and risk factors associated with musculoskeletal discomfort among vegetable street vendors.

Objectives: To find out prevalence of musculoskeletal discomfort in vegetable street vendors by using Nordic Musculoskeletal questionnaire.

To find out correlation between personal factors, working factors and musculoskeletal discomfort.

Materials and methodology: 125 Vegetable vendors were participated in this study. Age range between 18-60 years. Subjects having more than 5 years of experience are included.They were given consent form ,screening form and Nordic musculoskeletal questionnaire and the area of pain was marked by them on scale. The data was taken on excel sheet and data analysis was done then results were calculated.

Result: The prevalence of 69.60% was obtained in vegetable street vendors. The most body part involved are lower back 44.80% , ankle/feet 32% ,the least affected body parts are elbows and wrist/hands. The musculoskeletal discomfort is positively associated with gender, age and not associated with other factors such as BMI, work experience, working hours/day,working days/week, excessive repetition,sitting for long period at work,etc.

Conclusion: According to the present study there is a high prevalence of musculoskeletal disorders among vegetable street vendors in latur city. The commonly affected body region are lower back, ankle/feet and knees.

Keywords: Musculoskeletal discomfort, vegetable vendors, prevalence, association

INTRODUCTION

The condition that affect the joints, bones, and muscles are known as musculoskeletal disorders.[1] The common health problem among workers is musculoskeletal disorders due to intensive manual work.(1) Severe pain and physical disability which affects millions of workers across the world.(1) Musculoskeletal disorders reduces work productivity, increases absence due to ill health, it also affects working life and results in chronic occupational disability.[2]

Corresponding author: Aishwarya M. Rathod, Intern at SVSS Latur college of Physiotherapy.

Email: aishwaryarathod502@gmail.com,

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Work related musculoskeletal disorders can be said to be disorders of the soft tissue and their surrounding structures.[3] The movements in work activities causes painful disorders and symptoms related to musculoskeletal apparatus thus are named as work related musculoskeletal disorders[4]. Global burden of diseases , injuries and risk factors study (GBD) released in 2019 states that musculoskeletal disorders are among top 20 leading causes of disease burden for all ages and the lower back pain ranked 9th among 10 most important drivers of increasing burden.[4]

The largest contributors to the occupational disease burden are the work related musculoskeletal disorders and are mostly related to ergonomic factors found in workplace[5]. The WHO(World health organizations) states that musculoskeletal conditions are most common causes of disability limitations related to daily living and gainful employment.[5]

Street vendors are defined as the distributors of goods and services at affordable prices and those who provide consumers with retail options and form a vital part of market of a city[6]. Street vendor the term in English is frequently used interchangeably with "hawker" and "street trader".[6] The major difference between street vendors is they use off street markets which can be public or private[6]. On regular basis many vendors work from same site.[6] The profits from vending is the primary source of household income for the vendors and their families.[6]

Street vending in India is a profession for many people as it requires low skills and small financial inputs.[7] Vegetable vendors play an important role in supplying vegetables and fruits to the consumers they also play a vital role in economic upliftment of population involved in cultivation.[8] So for the well being of society their health is major concern.[8] For serving the society sellers are engaged in process of selling fruits and vegetables face following problems that is finance , transportation, anatomical and physiological,etc.[8] Among this most harmful to health is anatomical problem, that is permanent damage of ligaments, bones and tendons due to repetitive work motion and awkward postural changes.[8]

There is a high risk of musculoskeletal injury in small scale fresh vegetable growers due to intensive manual work[9]. High energy expenditures, heavy spinal loading during lifting and carrying, highly repetitive movements and crawling, stooping and other difficult work postures are require at field work and for material handling.[9]

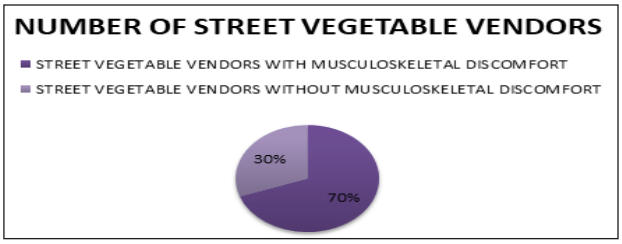
The factors contributing the occupational disorders are bad posture, repeated physical effort or psychological stresses.[10] Low back pain is most predominant risk of work related musculoskeletal disorders due to working for long hours and strenuous activity.[10] 14% of total urban informal employment in India constitute of street vendors.[11] The people with poor economy gets engaged in informal sector mainly in street vending.[11]

METHODOLOGY

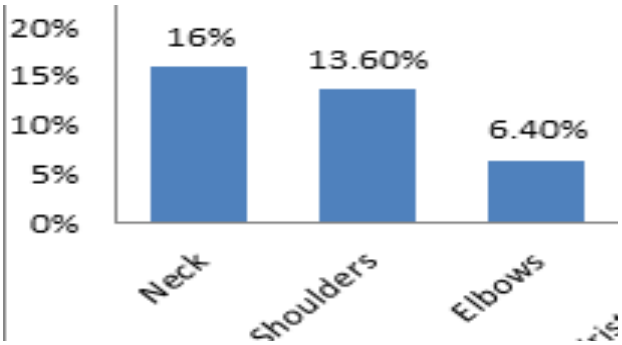
- **Study design:** Cross-sectional study.
- **Sample size :** 125
- **Study set up:** In and around Latur
- **Target population :** Vegetable street vendors.
- **Study duration :** 6 months
- **Type of sampling:** Convenient sampling

Ethical committee clearance was approved by the institutional ethical committee .125 participants were selected based on the inclusion and exclusion criteria. All the procedure was explained to them. The subjects were given the consent form. Personal factors and working factors was taken on screening form. Instructions regarding marking Nordic Musculoskeletal Discomfort questionnaire was explained to the subjects . The questionnaire was marked by the subjects. The data was collected and analysed. Final result was obtained.

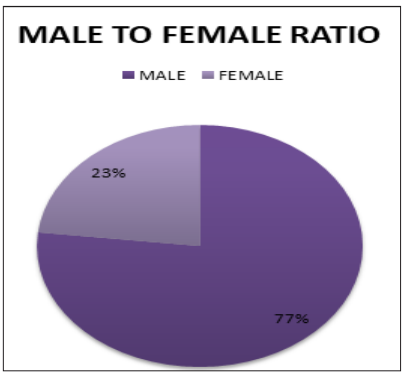
Result



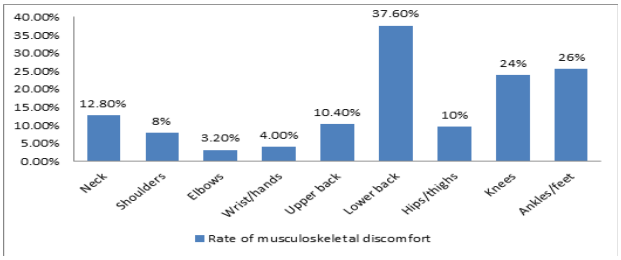
Graph 1: Prevalence of work related musculoskeletal discomfort in vegetable street vendors



Graph 3: Areas affected in past 12 months



Graph 2: Shows male to female ratio in street vegetable vendors



Graph4: Areas affected in past 7 days.

Table 1: The association between personal factors ,working factors and musculoskeletal discomfort among vegetable street vendors.

Particular	Having Pain		No Pain		Odd Ratio	95%CI	Chi square p-value
	Frequency	Percent	Frequency	Percent			
1. Gender							
Male	59	67.8	37	97.4	0.06	0.01-0.44	0.001*
Female	28	32.2	1	2.6			
2. Age							
<=35	36	41.3	23	60.5	0.46	0.21-2.72	0.036*
>35	51	58.7	15	39.5			
3. BMI							
<=24.9	59	67.8	32	84.2	0.40	0.15-2.77	0.058
>=25	28	32.2	6	15.8			
4.W eight of vegetable							
<=30	57	65.5	24	63.1	1.11	0.50-3.61	0.799
>30	30	34.5	14	36.9			
5. Work experience							
<=15	60	69	29	76.3	0.69	0.29-3.22	0.403
>15	27	31	9	23.7			
6. Working days per week							
3-5 days	6	6.8	4	10.5	0.63	0.17-3.58	0.491
6-7 days	81	93.2	34	89.5			

7.Working hours per day							
<=10	34	39	19	50	0.64	0.30-3.04	0.255
>10	53	61	19	50			
8.Excessive repetition							
Fewer	19	21.8	12	31.6	0.61	0.26-3.07	0.246
Often	68	78.2	26	68.4			
9.Sitting for long period at work							
Fewer	36	41.4	19	50	0.71	0.33-3.14	0.371
Often	51	58.6	19	50			
10. Lifting or carrying weights							
Fewer	16	18.4	12	31.4	0.49	0.20-2.87	0.103
Often	71	81.6	26	68.6			
Note: OR-odds ratio, 95% CI - 95% confidence intervals (CI), Chi-square test ($\chi 2$) and *Significant at p-value < 0.05							

RESULT

Incidence of Work related musculoskeletal discomfort in different body parts

Table 1 indicates street vegetable vendors with musculoskeletal disorders. The total prevalence of musculoskeletal discomfort among vegetable street vendors is 69.60% mainly involving lower back, ankle, feet, knees, upper back and neck.

Demographic characteristics analysis

A total of 96 male (76.80%) and 29 female (23.20%) were included and their age ranged from 18-60 years (mean 38.04±13.82 years). A total of 59 (47.2%) of the participants were 35 years old or younger and 66(52.8%) were over 35 years old. The body mass index values ranged from 13kg/m^2 to 45kg/m^2 (mean 22.04±4.86 kg/m^2).

The musculoskeletal discomfort were significantly associated with gender and age (Table 5) (P<0.05).The odds ratio shows that females have more musculoskeletal discomfort compared to males. The vegetable vendors over 35 years old have more musculoskeletal discomfort compared to 35 year old or younger. And musculoskeletal discomfort were not associated with body mass index values(P > 0.05).

Work related factor analysis

The working experience among vegetable street vendors ranged from 5 to 40 years (mean 21.11±12.08 years). The weight of vegetables ranged from 5 to 60 kg the mean average is 31.36±18.45 kg. The working hours ranged from 5 to 16 hours/day, the mean average is 10.5±3.60 hrs/day. The working days ranged from 3-7 days/week, majority of vegetable street vendors 115 (92%) works for 6-7 days/week and 10 (8%) vegetable street vendors works for 3-5 days/week.

The majority of vegetable street vendors 94 (75.2%) were often/ always lifting or carrying weights . 94(75.2%) vegetable vendors often or always worked with excessive repetition. A total of 70(56%) of the vegetable street vendors worked often/ always sitting for a long time.

The other working factors such as weight of vegetable, excessive repetition, sitting for long period, work experience, working hours/day, and working days/week were not significantly associated with musculoskeletal discomfort, (P >0.05).

DISCUSSION

The study was done to observe prevalence and risk factors associated with musculoskeletal discomfort in vegetable street vendors. As per the data by using Nordic musculoskeletal questionnaire the study shows that the overall prevalence of work related musculoskeletal

discomfort is 69.60% in vegetable street vendors and the common body sites affected are lower back, ankles/feet, knees ,upper back and neck. The total prevalence is consistent with reports from a study in Tehran (78.3 ± 6.8).[21] Pain in different body parts occurs due to longer duration of work at awkward position like squatting posture, bending at back, sitting at low level, sitting directly on the floor with leg stretching, sitting on feet ,bending at waist level, bending forward, bending at back while carrying load, carrying load on shoulder, twisting of body while picking up vegetables arranged at different levels.[12]

The previous study states that the prevalence of low back pain is highest in vegetable vendors.[19] Working long hours and engaging in strenuous activities can significantly increase the risk of developing low back pain, a prevalent issue in work related musculoskeletal disorders.[15] The WHO bulletin highlights that low back pain is linked to poor work postures, including bending of the trunk with heavy loads, simultaneous bending and twisting of the trunk, maintain a twisted posture for extended periods and repeatedly performing trunk movements.[15]

Gender was found significantly associated with musculoskeletal discomfort, with females reporting a higher prevalence compared to males. A study by Feng yang shows similar results[(22)].As female vendors have smaller body build so are less able to bear loads as compared to male.[22]

Age was identified as another important factor associated with musculoskeletal discomfort. Older vegetable street vendors (>35years) reported a higher prevalence of discomfort compared to their younger (≤ 35) vegetable street vendor. A study by Yan Yang reported positive association between age and musculoskeletal discomfort among furniture manufacturing workers.[4] Musculoskeletal physiology and structure may change with age leading to decline in physical fitness and endurance, other factors like career length could play a more influential role in causing work related musculoskeletal disorders.[4]

BMI as an indicator of body size and composition, did not show statistically significant association with musculoskeletal discomfort in this study.

Among the working factors examined, Work experience was found to have a no association with musculoskeletal discomfort. This is different from a study by Kanjanar Pintakham,et.al. which shows positive association between work experience and musculoskeletal discomfort.[18]

Other working factors, such working hours/day and working days/week did not show statistically significant associations with musculoskeletal discomfort in this study. This result is different from present study results, Obinna Chinedu Okezue, et.al. states that there is association between working hours and musculoskeletal disorder.[23] In vegetable street vendors the peak business hours are between 9 am to 12 noon, and has maximum selling and is minimum between 12 to 2 pm.[24] There is an substantial variation in terms of hours, days and months in which vendors sell. 6% of the street vendors demonstrates an inconsistent or variable selling schedule.[25]

Sitting for long period at work shows no association with musculoskeletal discomfort. According to a recent systematic review, poor sitting posture and lack of daily physical activity could strongly predispose individuals to lower back pain when associated with sitting , not solely during prolonged sitting periods[(22)].

Excessive repetition shows no association with musculoskeletal discomfort this result is same as study by Obinna Chinedu Okezue ,et.al.[(23

CONCLUSION

According to the present study there is a high prevalence of musculoskeletal disorders among vegetable street vendors in latur city. The commonly affected body region are lower back, ankle/feet and knees. The moderate affected areas are neck, upperback shoulders and hips. The least affected areas are elbows and wrist. In this study we found that several factors like age, gender are associated with musculoskeletal discomfort.We also found that certain work related factors, such as lifting or carrying weight, working hours/day, working days/week, work experience,excessive repetition, sitting for long period, weight of vegetable were not associated with musculoskeletal discomfort.

Ethical clearance:-Taken from department of SVSS Latur College of physiotherapy

Source of funding -Self

Conflict of interest: The author declares no conflict of interest to this work. This research received no specific grant from any funding agency, commercial or not for profit sectors. Ethical clearance for this study was obtained from the Institutional Ethics Committee (IEC) and all participants provided written informed consent.

REFERENCES

1. Mukul khutale, Amrutkuvar Jadhav "Prevalence of musculoskeletal disorders in food stall workers", Indian Journal of Public Health Research And Development, May 2020;11(05),244-248.
2. Qingmin Feng, Shenglin Liu, et.al. "The Prevalence of and Risk Factors Associated with Musculoskeletal Disorders among Sonographers in Central China: A Cross-Sectional Study", PLoS ONE, October 3 2016, 11(10)
3. Thomas R.L Hales, MD, and Bruce P. Bernard, MD, MPH. "Epidemiology of work related musculoskeletal disorders" ,Orthopaedic Clinics Of North America, 1996 October;27(4),679-709.
4. Yan Yong , Jiancheng Zeng, et.al. "Prevalence of musculoskeletal disorders and their associated risk factors among furniture manufacturing workers in Guangdong China: A Cross –sectional Study" , International Journal of Environmental Research and Public Health;4 November 2022, 19,14435
5. K. Saraswathi Krishnan, Gunasunderi Raju,et.al. "Prevalence of work related musculoskeletal disorders: Psychological and physical risk factors", International Journal of Environmental Research and Public Health,4 September 2021,18, 9361
6. Avi Jain, Kanksha Shah, et.al. "A comparative study of member based and non member based vegetable and fruit vendors under decent work in Ahmedabad city." Imperial Journal of interdisciplinary research,2016 Vol-2, (4).
7. S Vijaya Rani. Women in unorganised Sector –"Women vegetable Vendors in Tiruchirappalli – A Socio Economic Study",Indian journal of applied research April-2016 ;6(4),70-72.
8. Saikia Ranimia, "Musculoskeletal discomfort perceived by perishable good sellers in hilly areas", Asian Journal of Home Science, December 2017 ,Vol. 12(2), 385-389
9. Larry J Chapman, A strid C Newenhouse,et.al. "Evaluation of an intervention to reduce musculoskeletal hazards among fresh market vegetable growers" ,Applied ergonomics, January 2004;35(1),57-66
10. Samiksha Sathe, Mrunal Baxi, et.al. "Ergonomic Evaluation of Street Vendors as Determined by Rapid Entire Body Assessment Method". Int J Cur Res Rev ,April 2021;13(08),62-66.
11. Sonu R. Meher, Pushkar S. Ghatole "A study of common health problems and utilization of healthcare facilities among self-employed street vendors of Chandrapur district of Maharashtra" International Journal of Community Medicine and public Health.,2020 Jul;7(7):2782-2789.
12. Mthombeni D. L. , Anim F. D. K. , et.al. "Factors that contribute to vegetable sales by hawkers in the Limpopo Prvince of South Africa", Journal of Agricultural Sciences; July 15 2014 ,Vol. 6(8),197-204
13. Trivedi S.M, Khunta K.A ,et.al. "Performance And Problems Of Women Vegetable Vendors In Saurashtra Region", International Journal of Agriculture Sciences, 2019;11(6),8157-8159.
14. Kanjanar Pintakham, Wattasit Siriwong. "Prevalence and risk factors associated with musculoskeletal discomfort among street sweepers in Chang Rai Province Thailand." J Health Res., June 2016;30(3),207-213.
15. Dr. Shrikant Sunil Sant, Mr. Yashkumar K. Agrawal, et.al. "Prevalence of Low Back Pain in Vegetable Vendors of Loni Village". International Journal of Health Sciences and Research, August 2017;7(8),165-169.
16. .Aulia Chairani. "Validity And Reliability Test of the Nordic Musculoskeletal Questionnaire with Formal and Informal Sector Workers". The 7th International Conference on Public Health Solo, Indonesia, November 2020;100-106
17. Mostafa Pouyakian, Mehdi Kangavari,et.al. "The prevalence of musculoskeletal discomfort in the fruit and vegetable markets workers of Tehran and factors affecting disorders",Pjouhan Scientific Journal;2019,Vol 17(4),47-54.
18. Feng Yang, Niu Di,et.al "The prevalence and risk factors of work related musculoskeletal disorders among electronics manufacturing workers: a cress-sectional analytical study in China",BMC Public Health,2023; 23(10).
19. Okezue Obinna Chinedu, Anamezie Toochukwu Henry, et.al. "Work related musculskeletal disorders among office workers in higher education institutions: A cross – sectional study", Journal of Health Science,March 2020,30(5),715-724.
20. Ghanghoriya M. , Sharma V., et.al. "Woman vegetable vendor; A microeconomic study 2023".
21. Sean C. Lucan, Monica Varona ,et.al. "Assessing mobile food vendors (a.k.a. street food vendors)- methods, challenges and lessons learned for future food- environmental research", Public Health; August 2023; 127(8), 766-776.

Research Article

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The Impact of Myofascial Release Therapy and Deep Oscillation Therapy on Hamstring Muscle Length and tone in Children with Spastic Cerebral Palsy: A Comparative Study

Avilash Mohapatra[1*], Monalisha Pattnaik[2], Patitapaban Mohanty[3]

[1]Physiotherapist, Department of Surgical Discipline, AIIMS, New Delhi-110029, [2]HOD,Department of Physiotherapy,SVNIRTAR,Olatpur, Cuttack,Odisha, [3]Director, SVNIRTAR, Olatpur, Cuttack,Odisha

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ABSTRACT

BACKGROUND: As a result of restricted joint range of motion due to spasticity in patients with spastic cerebral palsy, the patient's ability to regain normal functioning may be hindered.

PURPOSE: To evaluate the effectiveness of Myofascial Release Therapy (MFR) versus Deep Oscillation Therapy (DOT) in helping children with spastic cerebral palsy to relax and extend their hamstring range of motion.

METHODOLOGY: A total of 32 individuals with spastic cerebral palsy, aged 2 to 10, were recruited for this comparative experimental study through a method of random sampling. Sixteen subjects were assigned to each group. Group 1(N=16) received two sessions of MFR with conventional exercise per day, whereas Group 2(N=16) received a single session of DOT with conventional exercise per day. Throughout the course of four weeks, both groups got therapy five days per week. A universal goniometer was used to compare the knee extension passive range of motion (PROM), active range of motion (AROM), and Popliteal angle (POP angle) measurements between the pre- and post-treatment periods. Statistical analyses were conducted using ANOVA 2×2 and Post hoc tables.

RESULT: Both groups' post-mean values for each of the dependent variables (AROM, PROM, and POP angle) statistically improved ($p< 0.05$). Both groups' mean differences in the PROM and POP angles were statistically significant, and Group 1's spastic hamstring muscle was more improved than Group 2's, but both groups' AROM showed almost equal improvement.

CONCLUSION: In children with spastic cerebral palsy, both MFR and DOT, when combined with conventional therapy, reduce spasticity and increase length (AROM & PROM) in the hamstring muscle. However, our study clearly shows that MFR is more successful than DOT.

Keywords: Myofascial release, Deep Oscillation Therapy, Spastic Hamstring muscle, Spastic cerebral palsy, passive range of motion

INTRODUCTION

"Non-progressive but not unchanging disorder of movement and/or posture, caused by an injury or anomaly of the developing brain," is how Cerebral Palsy is defined. A range of disorders characterized by motor dysfunction brought on by non-progressive brain injury inflicted early in infancy are together referred to as cerebral palsy. Brain injury can be caused by a variety of factors, such as abnormal brain

Corresponding author: Avilash Mohapatra, Physiotherapist, Department of Surgical Discipline, All India Institute of Medical Science, New Delhi-110029

E-mail: physioavilash09@gmail.com

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development, anoxia, intracranial bleeding, severe neonatal asphyxia (hypoxic ischemic neonatal encephalopathy), trauma, hypoglycemia, viruses, and other illnesses. In every instance, the insult targets an immature neurological system, and the damaged nervous system causes the immature nervous system to continue developing [1]. Spasticity, a feature of higher motor neuron lesions, is frequently brought on by damage to descending pathways and results in a variety of motor and sensory abnormalities [2]. The increase in the muscle's velocity-dependent joint resistance to passive motion is known as spasticity. Spasticity is a serious condition that can have negative effects on one's ability to function, including pain [3]. In spasticity, the loss of supraspinal control of descending pathways that control excitatory and inhibitory influences on proprioceptive, cutaneous, and nociceptive spinal reflexes is typically the cause of the primary deficits brought on by an upper motor neuron lesion (UMNL).

According to its definition, MFR is "the facilitation of mechanical, neural, and psycho-physiological adaptive potential as interfaced by the myofascial system".[4] This is accomplished by altering the viscosity of the ground substance of the fascia, stretching the cross-links and the muscle elastic fascia components.[5]

A restricted tissue barrier is going to experience histological length alterations as a result of prolonged pressure, according to the MFR. A sense of perceptible release is felt after 90–120 seconds, and the tissue becomes softer and flexible [6]. According to some study, MFR is a specialized, supplemental technique to loosen and realign muscles and may help young children with spastic CP improve their motor function.

A low-intensity electrical current is delivered at various frequencies in deep oscillation, a relatively recent therapeutic method. When it used manually, an intermittent electrostatic field arises between the practitioner's hands and the subject's tissues, resulting in a penetrating vibratory action that removes excess fluid or adhesions deep inside the tissue. The deep oscillation may change interior tissue temperatures or trigger nerve endings to increase the flexibility of soft tissues as it moves the fluid. By these mechanics, it improves the length of tighten muscles. DOT, however, isn't considered as a thermal modality [7]. Patient compliance is frequently high, and outcomes are frequently positive because DOT has not been associated with any side effects or discomfort, even though it is a new device, it is safe for application. [8]

The mechanism of DOT may be similar to whole body vibration (WBV) because it creates a vibration effect. Some studies report that after receiving treatment, the WBV group's gross motor function improved and their degree of knee extensor stiffness dramatically decreased.

AIM OF THE STUDY

There are several ways to reduce spasticity, but in this particular instance, we focused on novel treatments for the spastic hamstrings. We chose the hamstring muscle because it frequently impact CP children's walking patterns. This study assesses how DOT and MFR affect children with spastic CP in terms of reducing hamstring muscle stiffness and improving knee extension active and passive ROM.

METHODOLOGY

A total of 32 subjects (detail mentioned in Figure 1/flow chart of study design) were randomly assigned into Group 1 (MFR and Conventional therapy) 16 subjects and Group 2 (DOT and Conventional therapy) 16 subjects who met the inclusion criteria, and then parents or caregivers of the patients were asked to sign the informed consent form. They received verbal instructions in detail for the investigation.

Inclusion criteria

Patients must meet the following criteria to be included: Age range from 2 to 10 years, all sexes, TARDIEU scales "Quality of muscle reaction 1-4", participants who can move around on their own or with ambulatory assistance and popliteal angle less than 60°.

Exclusion criteria

Patients who have undergone or anticipate undergoing orthopedic surgery, received a

botulinum toxin injection within the past six months, had recent serial casting within last six months, used orally or intravenously administered myorelaxants, and have any cognitive or perceptual disorders are excluded from the study.

Outcome measures

- Active Range of Motion(AROM)
- Passive Range of Motion(PROM)
- Popliteal angle (POP angle): It assesses the tone of the hamstring muscle.

Measurement Tool

1. The Tardieu Scale-

Spasticity is assessed using the Tardieu scale, which considers resistance to passive movement at both slow and high rates. It takes into account the muscular reaction's quality, speed, and angle (Morris, 2002). The Tardieu Scale, which distinguishes between contracture and spasticity, shows enduring validity.

2. Universal Goniometer

In the present study, goniometry is used as a quantitative measurement tool. According to studies, the goniometric measurement of knee joint flexion's intratester and intertester reliability are 0.90 and 0.86, respectively, according to the ICC (Interclass Correlation Coefficient).

Intervention

Group 1 (16 samples) - (MFR + Conventional therapy)

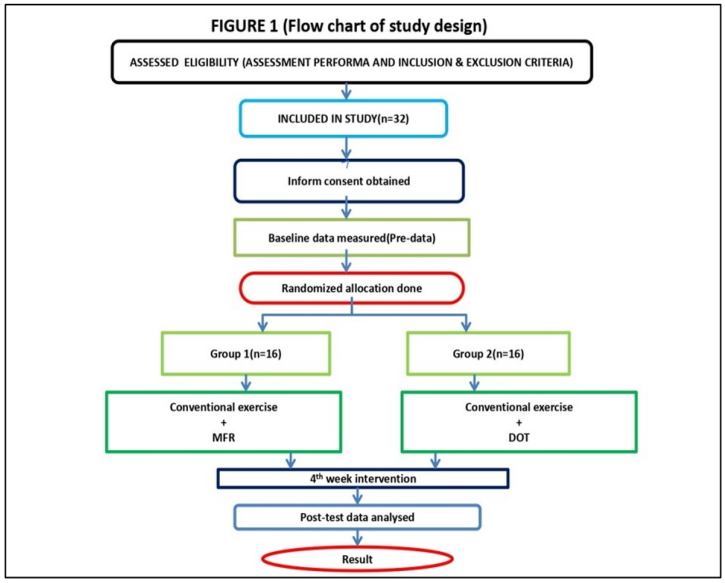

Fig. 2: Application of Myofascial Release Therapy/MFR.

The subject was in prone standing with the upper trunk supported by the chest arm component of the segmental mobilization bed and foot touch to the ground with the knee supported by one hand of the therapist, tried to extend to the full extent (Figure 2). The therapist was sitting on a bench behind the child and releasing the hamstring muscle from origin to insertion by using the thumb or heel of the other hand for 5 minutes, twice daily, five days per week, and four weeks total. Conventional exercises were provided.

Group 2 (16 samples) - (DOT + Conventional therapy)

The client's Position was the same as above, and the therapist was behind the client, applying DOT to the spastic hamstring muscle with a handheld applicator (Figure 3). The DOT machine's electrical current is programmed to oscillate for the first 10 minutes at a frequency of 150 Hz, then for the final 5 minutes at a frequency of 60 Hz (a total of 15 minutes) at an output of 80- 100%.The intervention was applied once daily for five days per week and 4weeks total. Conventional exercises were also provided.

Conventional therapy

The conventional exercises include bridging (unilateral and bilateral), half-kneeling to standing, sitting to standing, standing on one leg and stepping (forward, backward, and sides), as well as functional stretching for all tight structures. These are applied five days per week by therapists in the physiotherapy department.

DATA COLLECTION

Prior to starting the treatment programme, measurements were obtained, and they were done again once it was finished. Subjects were tested on all the dependent variables. The outcome measures (Knee AROM, Poplitial angle and PROM) were measured and mentioned in degree (0) in this study by using universal goniometer. Collected data was transcribed onto a data sheet for each subject separately. The ethical committee of the Institute gave its permission prior to the study's implementation.

DATA ANALYSIS

The study's collected data were statistically analyzed using Microsoft Office Excel 2007 and SPSS version 25.0 (Statistical Package for Social Sciences) for Windows. The dependent variables were analyzed using 2×2 ANOVA. There was one within factor (time) with two levels (Pre-test, Post-test) and one between factor (group) with two levels (Groups: MFR and DOT). The statistical level of significance for all pairwise Post-hoc comparisons was set at alpha=0.05.

RESULTS

KNEE EXTENSION PROM

After receiving therapy for four weeks, both groups showed improvements in knee extension PROM in the supine position, as shown in Figure 4(Graph: PROM of knee extension). In the post-treatment evaluations, Group 1 (MFR) significantly improved more than Group 2 (DOT). There was a major effect for time F (60.688), df(1), p=0.000, according to the ANOVA (TABLE 1).

Fig. 3 : Application of Deep Oscillation Therapy/DOT.

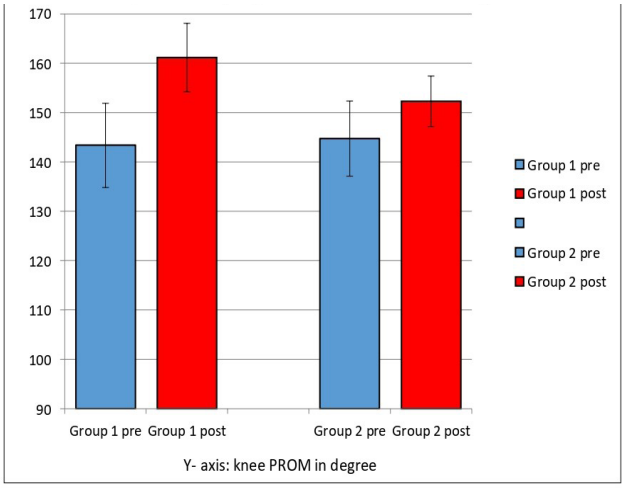

Fig. 4 : Graph Knee Extension PROM

ANOVA (TABLE 1)

FOR KNEE PASSIVE RANGE OF MOTION

Test of between and within subject effect

		SUM OF SQUARES	Df	MEAN SQUARE	F	SIGNIFICANCE
BETWEEN SUBJECT EFFECT	Group	225.000	1	225.000	3.730	0.063
	Error	1809.437	30	60.315		
WITHIN SUBJECT EFFECT	Time	2575.562	1	2575.562	6 0.688	0.000
	Time × Group	420.250	1	420.250	9.902	0.004
	Error	1 273.188	30	42.440		

Group F (3.730) did not have a main effect; df (1) p=0.063

The primary effects were qualified into the time group interaction, F (9.902), df(1), and p=0.004. Tukey's Post Hoc analysis revealed that both groups had significantly improved. At the end of the course of treatment, MFR was more efficient to DOT.

POPLITEAL ANGLE

After receiving treatment for four weeks, Figure 5 (Graph: knee popliteal angle/POP) shows an improvement in the Popliteal angle in both groups. Compared to Group 2, MFR considerably outperformed DOT in terms of post-treatment measures. According to the ANOVA (TABLE 2), time F (101.109) had a major effect with a df(1) p value of 0.000.

Group F(5.200) had a main effect (p=0.030, df(1).

Time group interaction F (4.208), df(1), p=0.049 was used to classify the major effects. Both groups significantly improved, according to Tukey's Post Hoc analysis. However, MFR ultimately outperformed DOT.

KNEE EXTENSION AROM

After receiving treatment for four weeks, both groups displayed improvement in knee extension AROM in high sitting positions, as shown in Figure 6 (Graph: AROM of knee extension). In the post-treatment assessments, Group 1 (MFR) improved significantly more than Group 2 (DOT).

According to ANOVA (TABLE 3) Time F (76.326) had a main impact, with a df(1) p-value of 0.000.

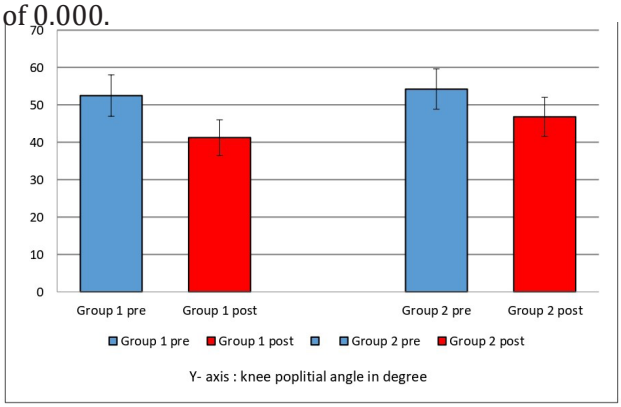

Fig. 5 : Graph Knee Popliteal angle/(POP)

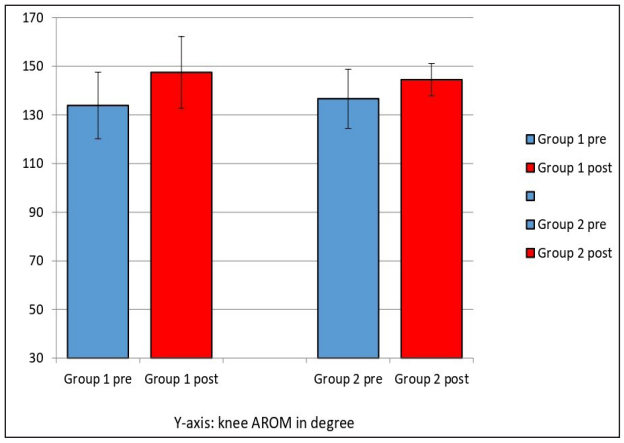

Fig. 6 : Graph AROM of knee extension

ANOVA (TABLE 2)

FOR POPLITIAL ANGLE

Test of between and within subject effect

		SUM OF SQUARES	Df	MEAN SQUARE	F	SIGNIFICANCE
BETWEEN SUBJECT EFFECT	Group	213.891	1	213.891	5.200	0.030
	Error	1233.969	3 0	41.132		
WITHIN SUBJECT EFFECT	Time	1396.891	1	1396.891	101.109	.000
	Time X Group	58.141	1	58.141	4.208	.049
	Error	414.469	30	13.816		

ANOVA (TABLE 3) FOR KNEE ACTIVE RANGE OF MOTION Test of between and within subject effect						
		Sum of squares	**Df**	**Mean square**	**F**	**Significance**
Between subject effect	Group	0.250	1	0.250	0.001	0.976
	Error	8231.500	30	274.383		
Within subject effect	Time	1849.000	1	1849.000	76.326	0.000
	Time × Group	132.250	1	132.250	5.459	0.026
	Error	726.750	30	24.225		

Group F (0.001) did not have a main effect, df(1) p= 0.976.

Time group interaction F (5.459), df(1), p=0.026 was used to classify the major effects. Turkey's Post Hoc analysis demonstrated that each group had improved. However, the mean difference was not statistically significant at the end of the treatment.

DISCUSSION

PROM of knee extension was measured before recruitment for the study and after completion of 4 weeks of the intervention by Universal Goniometry with slow velocity. Both groups (Groups 1 and 2) experienced significant improvements in PROM of knee extension after the intervention. There was a considerable difference between the mean post-test values between the groups. This showed that Group 1 was more improved than another group. Group 1(MFR) demonstrated a difference of 17.81^0 (12.4%) from pre-test (143.38^0) to post-test (161.19^0) values, whereas Group 2(DOT) demonstrated a difference of 7.56^0(5.2%) from pre-test (144.75^0) to post-test (152.31^0) values.

The PROM in Group 1 was improved more because of MFR. The probable mechanism for this could be that MFR improves tissue extensibility, blood flow, and lymphatic drainage and breaks adhesion. Another mechanism was the thixotropic property of fascia, which allowed softening of the soft tissue. This can be the result of the ground substance's viscosity decreasing during the application of myofascial soft tissue release. In support of my study result, [9] C.Kumar and S.N Vaidya (2014) showed the same effect of MFR on the hip joint's calf, hamstring, and adductor muscles of 30 participants. He came to the conclusion that the neuro-reflexive change brought on by using forceful pressure on the musculoskeletal system while administering MFR could be the most likely mechanism for results. The hands-on method stimulates afferent receptors, which in turn trigger spinal cord and cortical central processing. Efferent inhibition typically follows afferent stimulation. This idea is implemented in the MFR technique when a stretch is applied, and the operator waits for efferent inhibition to occur so that relaxation takes place.

Salvi Shah et al. conducted a study in which they analysed some literature on myofascial release and came to the conclusion that it was a very successful, delicate, and secure hands-on technique for soft tissue mobilisation. By enhancing circulation and nerve system transmission, it boosted the body's natural restoration abilities. The myofascial tissue was eventually able to extend and relax as a result of this low load sustained stretch, which led to an improvement in flexibility and range of motion [10].

Group 2 was taking DOT along with the same conventional exercise and result was also significant by increasing knee extension PROM.

This is supposed to be due to the vibration action produced by the DO device. When DOT was applied by using the handheld applicator, between the applicator and the tissue of the individual, an electrostatic field developed, this again created electrostatic attraction and friction; as a result penetrating vibration action was produced. This vibration action broke the excessive adhesion within the tissue. The penetrating effect was up to 8 cm depth in tissue level. So that the length of the hamstring muscle might be increased, resulting in improvement in knee extension PROM.

The study carried out by, [11] M.R.Hinmann(2013)et al. which was RCT on 15 athletes and non-athletes to estimate the effect of Ultrasound vs. Deep oscillation treatment on hamstring muscles. The length of the muscle was measured by passive SLR (Single Leg Raise) using an inclinometer. He concluded that both modalities significantly improved hamstring muscle length by both modalities but slightly more significant improvement gained in DOT than in Ultrasound. This study was also supporting my result.

Furthermore, the study supporting my result was done by, [12] Z.K. Winkelmann (2018) et.al was a randomized single cohort study on 29 physically active individuals who received DOT. The data (Passive SLR) was collected pre and post-time, and data were analyzed using a Pearson correlation and a dependent t-test. The result was found that there was a significant improvement in hamstring flexibility. This could be the possible reason that knee extension passive ROM might be increased.

From the analysis, it was found that between the two groups, the mean value after interventions were not similar. Both interventions had different effects after the completion of the duration of treatment, but comparatively, the MFR group demonstrated more improvement in mean value compared to the DOT group.

Popliteal angle was measured by goniometer in the child in supine lying posture and hip in 90^0flexion and knee fully flexed starting Position. Then passively extend the knee with a fast speed (greater than the natural drop speed) and measure the angle where the knee joint got caught. After four weeks of intervention, both Groups 1 and 2 experienced a considerable decrease in POP angle. But the reduction of POP angle in Group 1 was much better than that of Group 2. Group 1(MFR) demonstrated a difference of 11.25^0(21.4%) from pre-test (52.50^0) to post-test (41.25^0) values, whereas Group 2(DOT) demonstrated a difference of 7.44^0 (13.7%) from pre-test (54.25^0) to post-test (46.81^0) values.

POP angle was measured to know the rate of spasticity. POP angle was decreased; it means there was a reduction of spasticity of the hamstring muscle. Another way is if the flexibility or length of the hamstring muscle was increased, the POP angle was also reduced.

In Group 1, the probable mechanism for the result could be MFR was applied with slow velocity and firm pressure, which had a slow stretch effect on muscle and resulting firing of GTO (Golgi Tendon Organ) and lowered the tension in the spastic muscle, allowing the muscle's parallel elastic fibres (sarcomere) to lengthen. Therefore Hamstring spasticity might be reduced, and improvement of Poplitial angle.

Here supporting my study result, the study done by, [13] J.Paul(2018) etal. He did a study on 15 participants with diplegic CP who were intervened in MFR therapy on spastic hamstring muscle. The outcomes were measured by MAS and knee ROM by goniometry, which was analyzed through intra-group analysis. The result showed a significant reduction of spasticity and improvement of knee joint ROM.

In Group 2, DOT was applied, where vibration massage was produced between the applicator of the device and the subject tissue. Several studies showed vibration therapy significantly affected the reduction of spasticity. So vibration massage produced by the DO (Deep Oscillation) device helped decrease spasticity on hamstring muscle, resulting in reduced POP angle. The use of DOT as an intervention for minimizing spasticity in CP children is a somewhat unexplored field of study. To our knowledge, this study is the first to examine the impact of DOT on CP patients' spastic hamstring muscles.

Instrumental Vibration therapy had a better effect on the reduction of spasticity. The

mechanism is supposed to be vibration-stimulated by the skin receptors, proprioceptors, and muscle spindles via vibration transmission to the human body. We can infer that vibration stimuli detected by the brain cortex and processed by the central nervous system will have an impact on motor performance since proprioception is a crucial component of motor control. This presumption is in line with the findings of King and colleagues' (2009), who found that sound wave vibration therapy, improves motor symptoms and gait in Parkinson's disease patients.

Furthermore, a study by, [14]L.Ahlborg (2006), a prospective, randomized clinical trial on 14 children with diplegic spastic CP, intervened with either whole body vibration (WBV) or resistance training. The outcome spasticity and strength were measured by pre and post-data using MAS, muscle strength, six-minute walk test. He concluded that the group, who was taking WBV training, decreased knee extensor spasticity significantly. This study supports that vibration massage therapy helped in the reduction of spasticity.

The result of our study suggested that in each of the groups, knee extension AROM was improved significantly, but the difference between the two groups was not statistically significant. Group 1(MFR) demonstrated a difference of 13.63^0(10.2%) from pre-test (133.81^0) to post-test (147.44^0) values, whereas Group 2(DOT) demonstrated a difference of 7.88^0(5.7%) from pre-test (136.56^0) and post-test (144.44^0) values.

The mechanism of increased AROM in knee extension for both groups was overall the same. This was possibly due to the improvement of soft tissue extensibility of the hamstring muscle on the knee joint, which inhibits the abnormally increased tone of the hamstring. Once the abnormal tone of the hamstring muscle was reduced, the physiological restriction of active knee extension was reduced. Along with this, both the groups were taking conventional exercises, in which most of them were strengthening exercises of quadriceps muscle like half knee to standing, single leg standing, single leg bridging, and stepping (forward, sideway). Here child repetitively produced the active contraction of the quadriceps muscle. Conventional exercises might also contribute to the improvement of the active range of motion. MFR or DOT to antagonistic (spastic hamstring) muscle along with conventional strengthening exercise to agonist (weak quadriceps) muscle might significantly improve AROM.

But the post-mean difference value between the two groups was not statistically significant. Here I was applying particular extra interventions (MFR/DOT), which were passive intervention techniques. I thought because of this; there might be not showing statistically significant. Otherwise, by increasing the sample size, the difference may be significant. For this, further study may be needed.

CONCLUSION

The findings of this study suggest that both Myofascial release and Deep Oscillation Therapy were effective interventions for increasing active range of motion, passive range of motion and reduce the tone of spastic hamstring muscle in spastic cerebral palsy; however, Poplitial angle and PROM were improved more by Myofascial release therapy compared to DOT.

Clinical Implication

These can be easily incorporated into any rehabilitation technique (clinical or home-based setting). Early advice on strengthening exercise programs along with MFR/DOT can avoid the surgical intervention of spastic hamstring muscle in CP children.

Conflict of Interest: Nil

Source of Funding: Self

REFERENCES

1. Culav EM, Clark CH, Merrilees MJ. Connective tissues: matrix composition and its relevance to physical therapy. Physical therapy. 1999 Mar 1;79(3):308-19.
2. Aymard C, Katz R, Lafitte C, Lo E, Pénicaud A, Pradat-Diehl P, Raoul S. Presynaptic inhibition and homosynaptic depression: a comparison between lower and upper limbs in normal human subjects and patients with hemiplegia. Brain. 2000 Aug 1;123(8):1688-702.
3. Calancie B, Broton JG, Klose KJ, Traad M, Difini J, Ayyar DR. Evidence that alterations in presynaptic inhibition contribute to segmental hypo-and hyperexcitability af-

ter spinal cord injury in man. Electroencephalography and Clinical Neurophysiology/Evoked Potentials Section. 1993 Jun 1;89(3):177-86.
4. Barnes JF. Myofascial release: the "missing link" in your treatment. Norfolk, VA: Rehabilitation Services Inc. 1995.
5. Gregson JM, Leathley M, Moore AP, Sharma AK, Smith TL, Watkins CL. Reliability of the Tone Assessment Scale and the modified Ashworth scale as clinical tools for assessing poststroke spasticity. Archives of physical medicine and rehabilitation. 1999 Sep 1;80(9):1013-6.
6. Barnes JF. Myofascial release: The search for excellence: A comprehensive evaluatory and treatment approach. Baltimore: Rehabilitation Services.
7. Aliyev R. Clinical effects of the therapy method deep oscillation in treatment of sports injuries. Sportverletzung Sportschaden: Organ der Gesellschaft fur Orthopadisch-Traumatologische Sportmedizin. 2009 Mar 20;23(1):31-4.
8. Kraft K, Kanter S, Janik H. Safety and effectiveness of vibration massage by deep oscillations: a prospective observational study. Evidence-Based Complementary and Alternative Medicine. 2013 Jan 1;2013.
9. Kumar C, Vaidya SN. Effectiveness of myofascial release on spasticity and lower extremity function in diplegic cerebral palsy: Randomized controlled trial. Int J Phys Med Rehabil. 2014;3(253):2.
10. Bhalara A, Shah S. Myofascial Release. Internasional Journal of Health Sciences & Research. 2012 May;2(2).
11. Hinman MR, Lundy R, Perry E, Robbins K, Viertel L. Comparative effect of ultrasound and deep oscillation on the extensibility of hamstring muscles. Journal of Athletics Medicine. 2013 Jan;1(1):45-55.
12. Winkelmann ZK, Roberts EJ, Games KE. Acute effects and perceptions of deep oscillation therapy for improving hamstring flexibility. Journal of sport rehabilitation. 2018 Nov 1;27(6):570-6.
13. Paul J, Nathan SC, Kumar PR, Remya RK. Effectiveness of myofascial release in reduction of hamstrings spasticity among diplegic cerebral palsy children. IJMAES. 2018 Mar;4(1):453-8.
14. Ahlborg L, Andersson C, Julin P. Whole-body vibration training compared with resistance training: effect on spasticity, muscle strength and motor performance in adults with cerebral palsy. J Rehabil Med. 2006 Sep;38(5):302-8.

Case Study

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Advancing total knee replacement surgery Assessment with Wearable Sensors and AI: A Case Study

Bhairavi Ugale[1*], Ajay G[2], Anmol Saxena[3]

[1]BPT, Head of Clinical researcher, Ashva wearable technologies pvt ltd, Bangalore, Karnataka, [2]Ajay G. MPT in musculoskeletal and sports physiotherapist. Certified Manual therapist from FIMT, [3]Founder and CEO, Ashva Wearable Technologies Pvt Ltd, Bangalore, Karnataka, India.

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ABSTRACT

Background: India has a higher prevalence of about 20-24%.of people suffering from osteoarthiritis. Due to the load effect, forces between two and three times body weight are transmitted across the knee joint during a normal stride, which accounts for the higher risk of OA.A Qualitative Analysis of Decision-Making for Total Knee Replacement in Patients with Osteoarthritis. A cutting-edge wearable sensor system called Fitknees delivers a complex arrangement of motion sensors that are carefully placed on the lower limb. These sensors outline thorough kinematic data that include gait analysis, muscle strength, knee range of motion, and balance metrics.

Objective: Utilizing individualised measurements, using wearable sensors and AI tool to assess preoperative evaluations and postoperative rehabilitation programs.

Results: camping between affected and unaffected side with the normative data provided by the AI.Conclusion: advancement in the medical technologies have made it easier for medial professionals to detect and early diagnose the diseases. Plan a better treatment plan with the aid of artificial intelligence to achieve better results.

Keywords :- OA knee, Total Knee Replacement, wearable sensors, artificial intelligence, advanced diagnostics,

ABBREVATIONS

OA : Osteoarthritis

TKR- : Total Knee Replacement

TJR : Total joint replacement

INTRODUCTION

Osteoarthritis is the most common degenerative disease, affecting About 16% of the global population. India has a higher prevalence of about 20-24% of people suffering from ostroarthiritis.[1] OA risk rises significantly with age and is incredibly uncommon in anyone under the age of 30. Female sex, obesity, past joint damage (such as an ankle fracture or knee ligament rupture), atypical joint anatomy, and having family members with OA all raise the risk of getting the condition. Why focus more on the knee joint? This is because the lower limbs bear most of the body's weight, and flexible joints like the hip and knee are particularly affected.2 Due to the load effect, forces between two and three times body weight are transmitted across the knee joint during a normal stride, which accounts for the higher risk of OA. Therefore, the advancement of OA can occur over many years, with times of rapid progression leading

Corresponding author: Bhairavi ugalea, BPT, Head of Clinical researcher, Ashva wearable technologies pvt ltd, Bangalore, Karnataka.

E-mail: bhairavi.ashva@gmail.com

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to joint failure and total joint replacement (TJR) in the end. According to the incidence of TKR, which increased from 1% to 2% after three years and from 6-9% after 12 years, this population of older women is at a high risk of experiencing joint failure and requiring TJR.[3]

The OA knee is characterised by a complex combination of biomechanical forces and biochemical changes that lead to the gradual disintegration of articular cartilage. Synovial inflammation, the growth of osteophytes, subchondral bone sclerosis, and the subsequent constriction of joint spaces all exacerbate discomfort and limit mobility. The femur and tibia's diseased cartilage and bone are removed, and then metal and plastic prosthetic parts are inserted as a replacement. The tibial component replaces the top surface of the tibia, and a plastic spacer is inserted between the femoral component and the tibial component. Resurfacing the patellar undersurface is an option. The surgical closure of the joint capsule and incisions complete the surgery, which aims to restore joint stability and alignment. Following surgery, patients go through rehabilitation to restore knee function.

Clinical assessment, medical history review, physical examination, and imaging techniques are currently used in assessments of OA knee patients considering TKR surgery. X-rays can shed light on bone alterations, osteophyte development, and narrowing of joint spaces. Soft tissue structures can be viewed in great detail on an MRI scan. Additionally, diagnostic tools like the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the Knee Society Score help assess pain, stiffness, and function. Clinical assessment, medical history review, physical examination, and imaging techniques are currently used in assessments of OA knee patients considering TKR surgery. X-rays can shed light on bone alterations, osteophyte development, and narrowing of joint spaces. Soft tissue structures can be viewed in great detail on an MRI scan. The Knee Society Score and Western Ontario and McMaster Universities' diagnostic tools are additional considerations.[4]

A Qualitative Analysis of Decision-Making for Total Knee Replacement in Patients with Osteoarthritis can be decided on the basis of the investigations, which is X-rays, MRIs, and ultrasounds. The suggestion for surgery can be made based on the amount of damage the joint has, the level of pain, any deformities, and the grade of OA the patient is suffering. The amount of degenerative changes through X-ray and MRI. Patients with moderate to severe osteoarthritis may choose to have an elective knee replacement if their condition does not improve with treatment. These procedures are recognized to be highly beneficial to patients, demonstrating efficacy in terms of reducing pain, enhancing function, and enhancing quality of life.[5]

A paradigm change in OA knee evaluation is being presented by the convergence of wearable sensors and AI technology. A cutting-edge wearable sensor system called Fitknees delivers a complex arrangement of motion sensors that are carefully placed on the lower limb. These sensors outline thorough kinematic data that includes gait analysis, muscle strength, knee range of motion, and balance metrics. The combination of these indicators improves the previously limited assessment framework by providing a comprehensive viewpoint.[6]

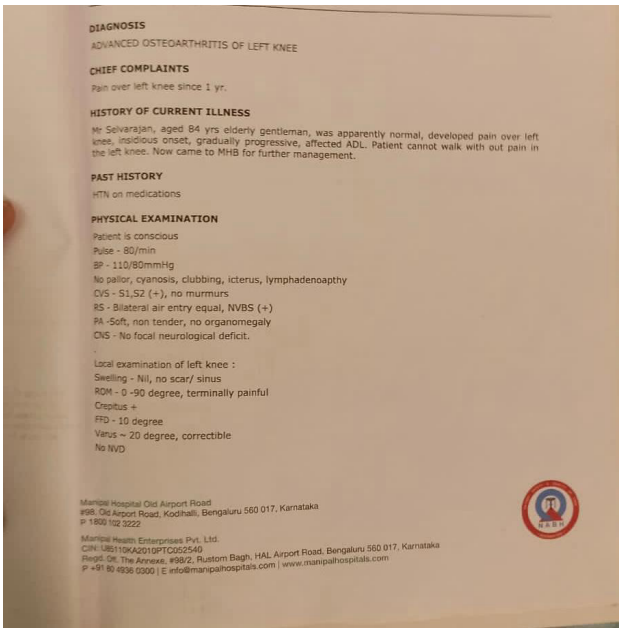
PATIENT HISTORY AND OBSERVATION

The patient's informed consent was obtained in order to conduct this case study. The entire process for using fitknees was discussed. An 84-year-old retired male complains of having had pain in his left knee for past 2 months. He came to the physiotherapy clinic as there was no pain relief. He was diagnosed with osteoarthritis 10 years back because of negligence, his condition is more severe. He had undergone total knee replacement surgery on his left knee 2 months back. The common symptoms of which he complained were morning stiffness, and crepitations in both limbs, along with numbness in the left lower limb. After being operated 2 months back he was doing basic physiotherapy exercises which helped him in pain relief, improved range of motion, and improved

muscle strength. He had difficulties in complete knee movement, walking, and stair climbing without support. On observation, he has swelling over the knee along with foot, and a healed 12 cm healed scar over knee joint. Left knee slight flexed, left knee in valgus, posteriorly right-sided thoracic scoliosis.

On evaluation, the knee joint tender on the posterior side, and crepitations on both the knee joint. Extension lag was seen on left lower limb.

INVESTIGATIONS



DIAGNOSIS
ADVANCED OSTEOARTHRITIS OF LEFT KNEE

CHIEF COMPLAINTS
Pain over left knee since 1 yr.

HISTORY OF CURRENT ILLNESS
Mr Selvarajan, aged 84 yrs elderly gentleman, was apparently normal, developed pain over left knee, insidious onset, gradually progressive, affected ADL. Patient cannot walk with out pain in the left knee. Now came to MHB for further management.

PAST HISTORY
HTN on medications

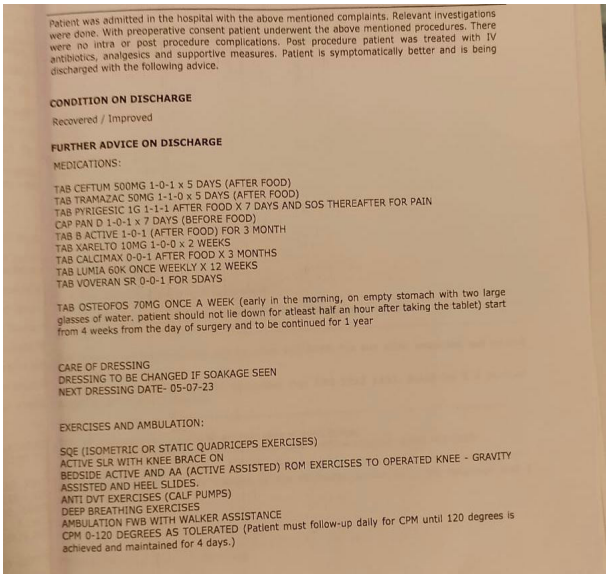
PHYSICAL EXAMINATION
Patient is conscious
Pulse - 80/min
BP - 110/80mmHg
No pallor, cyanosis, clubbing, icterus, lymphadenoapthy
CVS - S1,S2 (+), no murmurs
RS - Bilateral air entry equal, NVBS (+)
PA -Soft, non tender, no organomegaly
CNS - No focal neurological deficit.

Local examination of left knee :
Swelling - Nil, no scar/ sinus
ROM - 0 -90 degree, terminally painful
Crepitus +
FFD - 10 degree
Varus ~ 20 degree, correctible
No NVD

Manipal Hospital Old Airport Road
#98, Old Airport Road, Kodihalli, Bengaluru 560 017, Karnataka
P 1800 102 3222

Manipal Health Enterprises Pvt. Ltd.
CIN: U85110KA2019PTC052540
Regd. Off. The Annexe, #98/2, Rustom Bagh, HAL Airport Road, Bengaluru 560 017, Karnataka
P +91 80 4936 0300 | E info@manipalhospitals.com | www.manipalhospitals.com

Fig. 1: Medical Diagnosis of patient



Patient was admitted in the hospital with the above mentioned complaints. Relevant investigations were done. With preoperative consent patient underwent the above mentioned procedures. There were no intra or post procedure complications. Post procedure patient was treated with IV antibiotics, analgesics and supportive measures. Patient is symptomatically better and is being discharged with the following advice.

CONDITION ON DISCHARGE
Recovered / Improved

FURTHER ADVICE ON DISCHARGE
MEDICATIONS:

TAB CEFTUM 500MG 1-0-1 x 5 DAYS (AFTER FOOD)
TAB TRAMAZAC 50MG 1-1-0 x 5 DAYS (AFTER FOOD)
TAB PYRIGESIC 1G 1-1-1 AFTER FOOD X 7 DAYS AND SOS THEREAFTER FOR PAIN
CAP PAN D 1-0-1 x 7 DAYS (BEFORE FOOD)
TAB B ACTIVE 1-0-1 (AFTER FOOD) FOR 3 MONTH
TAB XARELTO 10MG 1-0-0 x 2 WEEKS
TAB CALCIMAX 0-0-1 AFTER FOOD X 3 MONTHS
TAB LUMIA 60K ONCE WEEKLY X 12 WEEKS
TAB VOVERAN SR 0-0-1 FOR 5DAYS

TAB OSTEOFOS 70MG ONCE A WEEK (early in the morning, on empty stomach with two large glasses of water. patient should not lie down for atleast half an hour after taking the tablet) start from 4 weeks from the day of surgery and to be continued for 1 year

CARE OF DRESSING
DRESSING TO BE CHANGED IF SOAKAGE SEEN
NEXT DRESSING DATE- 05-07-23

EXERCISES AND AMBULATION:

SQE (ISOMETRIC OR STATIC QUADRICEPS EXERCISES)
ACTIVE SLR WITH KNEE BRACE ON
BEDSIDE ACTIVE AND AA (ACTIVE ASSISTED) ROM EXERCISES TO OPERATED KNEE - GRAVITY ASSISTED AND HEEL SLIDES.
ANTI DVT EXERCISES (CALF PUMPS)
DEEP BREATHING EXERCISES
AMBULATION FWB WITH WALKER ASSISTANCE
CPM 0-120 DEGREES AS TOLERATED (Patient must follow-up daily for CPM until 120 degrees is achieved and maintained for 4 days.)

Fig. 2: Medications given to patient

Radiological investigation

Pre- surgery

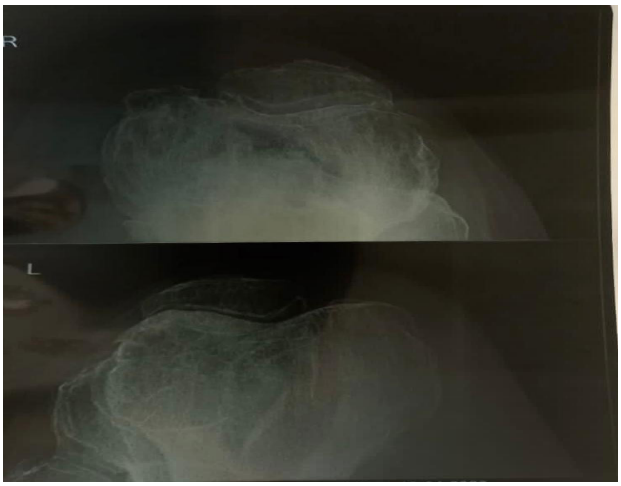


Fig. 3: Patella in knee flexion in anterior view both right and left knee.

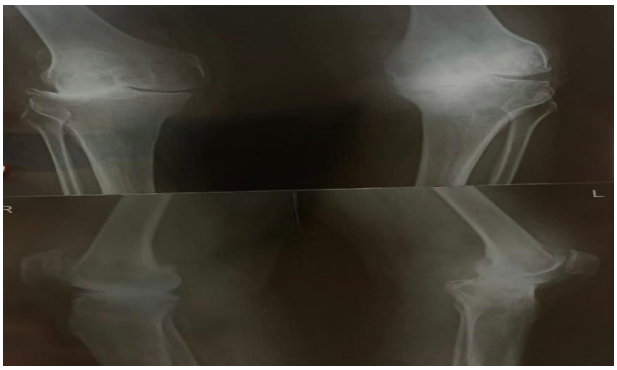


Fig 4.Knee joint in anterior and lateral view both right and left knee.

Post- surgery

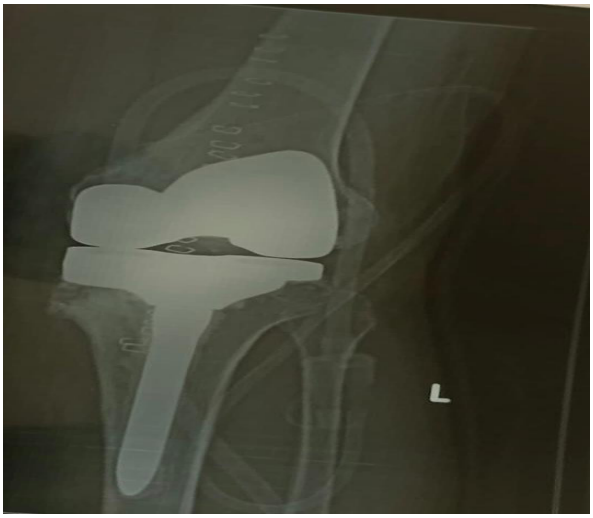


Fig. 5: Knee joint with implant

Fig 5&6. Knee joint with implant in anterior and lateral view

PHYSIOTHERAPY TREATMENT

- Neuromuscular electrical stimulation - 10 mins for quadriceps muscle.
- Isometric exercises for Quadriceps and hamstrings.
- Strengthening exercises
- Proximal muscles - Hip flexion
- Hip Extension
- Hip Abduction
- Resistance band exercises- gluteus muscle bridges
- Exercises to fixed flexion deformity- passive knee flexion
- Balance training- Spot marching
- Walk standing with hold B/L
- Single leg standing with support B/L
- Gait training- Short hurdles
- Tandon walking
- Side walking
- Backward walking

RESULTS

Comparing both the affected and unaffected with different clinical parameters

Range of motion

Flexion range of motion was calculated for both the sides, where the left limb is an affected limb and right is not affected, this graph shows that the range of rotation on the affected side is reduces as compared to unaffected side where the normal range for knee flexion is >125.

Muscle strength

This graph quantifies the amount of muscle strength. As there is reduced muscle strength in the affected limb as compared to the unaffected limb.

Proprioception

The joint position sense tested actively. This graph shows that the proprioception is more affected on the limb which is operated with TKR.

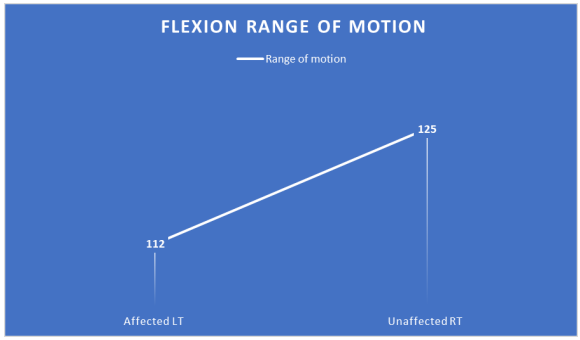


Fig. 7: Comparison between range of motion

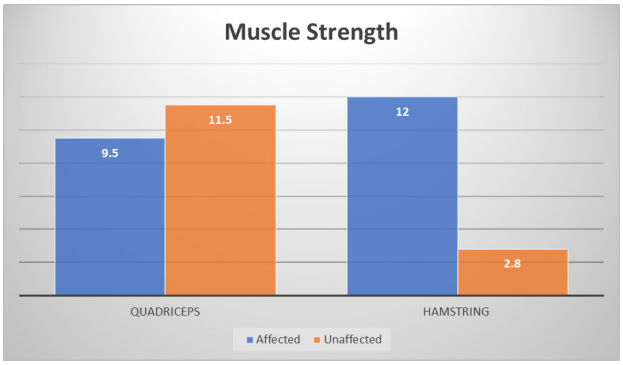


Fig. 8: Comparison between muscle strength

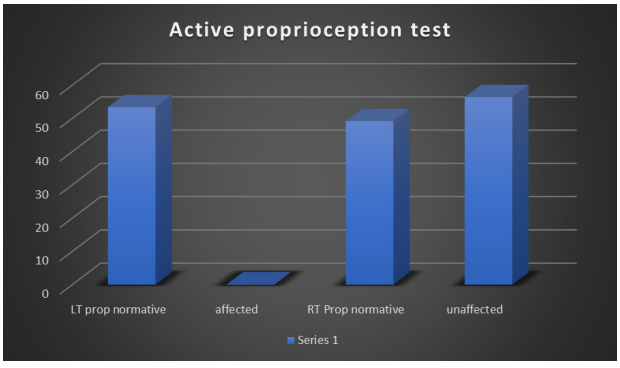


Fig. 9: Comparison between proprioception

Dynamic balance

The graph represents the normal average time taken to complete tug test and the actual time taken by the patient thus more the time taken to complete the test more is the risk of fall.

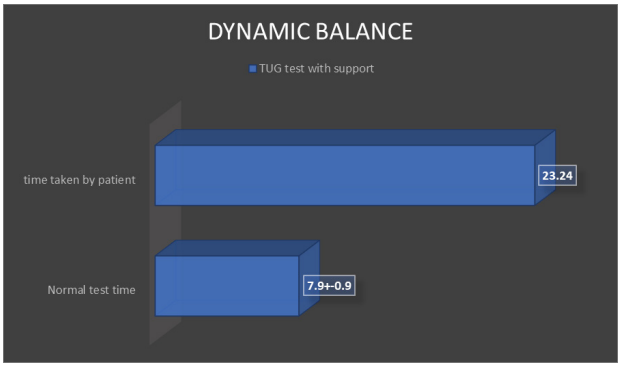


Fig. 10: Comparison between dynamic balance

Gait analysis

Alteration in the gait parameters is seen in the following graphs on the affected and unaffected sides compared to the normative ranges for each of the gait parameters. Which shows us that stance phase,stride length,step length and cadence is reduced as compared to normal.

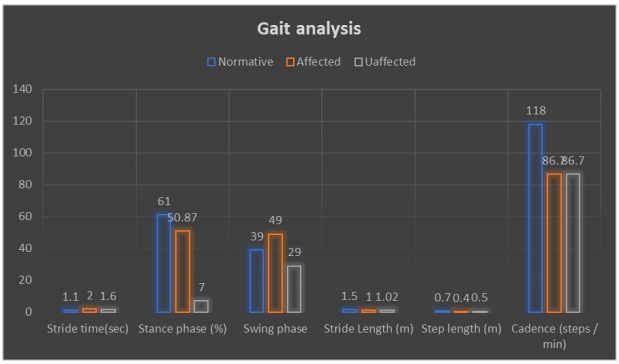


Fig. 11: Comparison between gait

As a result, all of the outcomes are compared to the patient's actual motions and the normative ranges that the AI offers.

DISCUSSION

The case study, which is explained in medical jargon, and the reference piece highlight the potential advantages of using AI as a tool for assessing post-operative knee arthroplasty. When compared to conventional human evaluations, the AI tool demonstrates increased accuracy, consistency, and expediency. Additionally, it exhibits a propensity for spotting issues in their early stages, leading to improved patient care.

But integrating AI technologies into clinical settings requires resolving issues with data privacy, algorithmic validity, and the interface between AI and medical specialists. While AI has the potential to enhance evaluations, it is crucial to view it as a supplemental tool that works in concert with medical professionals' clinical judgment rather than as a replacement for it.

In order to fully realize the promise of AI for post-operative evaluations and other medical domains, it is essential to conduct ongoing research, collaborate synergistically with medical professionals and AI experts, and adhere unwaveringly to ethical standards.[7]

PICTURES

Pic. 1: Lt side affected, swelling present

Pic 2&3: Showing anterior and posterior view

Ethical clearance – Ethical clearance obtained from ST. John's National Academy of Health sciences

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Conflict of interest: nil

REFERENCES

1. Cui A, Li H, Wang D, Zhong J, Chen Y, Lu H. Global, regional prevalence, incidence and risk factors of knee osteoarthritis in population-based studies. EClinicalMedicine [Internet]. 2020;29–30(100587):100587. Available from: http://dx.doi.org/10.1016/j.eclinm.2020.100587
2. 2. Calce SE, Kurki HK, Weston DA, Gould L. The relationship of age, activity, and body size on osteoarthritis in weight-bearing skeletal regions. Int J Paleopathol [Internet]. 2018;22:45–53. Available from: http://dx.doi.org/10.1016/j.ijpp.2018.04.001
3. Bager CL, Karsdal M, Bihlet A, Thudium C, Byrjalsen I, Bay-Jensen AC. Incidence of total hip and total knee replacements from the prospective epidemiologic risk factor study: considerations for event driven clinical trial design. BMC MusculoskeletDisord [Internet]. 2019;20(1). Available from: http://dx.doi.org/10.1186/s12891-019-2680-3
4. Halewood C, Athwal KK, Amis AA. Pre-clinical assessment of total knee replacement anterior-posterior constraint. J Biomech [Internet]. 2018;73:153–60. Available from: http://dx.doi.org/10.1016/j.jbiomech.2018.03.042
5. Suarez-Almazor ME, Richardson M, Kroll TL, Sharf BF. A qualitative analysis of decision-making for total knee replacement in patients with osteoarthritis. J Clin Rheumatol [Internet]. 2010;16(4):158–63. Available from: http://dx.doi.org/10.1097/RHU.0b013e3181df4de4
6. Root User. Home [Internet]. Ashva - Making Musculoskeletal Healthcare Data-Driven. Ashva; 2022 [cited 2023 Oct 11]. Available from: https://www.ashva.xyz
7. Integration of Convolutional Neural Networks for AI-Enhanced Post-Operative Assessment in Knee Arthroplasty: A Comparative Study" by Johnson et al. Journal of Orthopedic Informatics. 2023;

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Comparison of Obliques Muscles Strength Between Left and Right Side in Normal Young Adults Using Handheld Dynamometer - A Pilot Study

[1]Bharati Asgaonkar, [2]Nikita Singh

[1]Bharati Asgaonkar, Associate Professor, Physiotherapy School and Centre, TNMC & BYL Nair Charitable Hospital, Mumbai, Maharashtra, India [2]Postgraduate Student (Musculoskeletal Physiotherapy) Physiotherapy School and Centre, TNMC & BYL Nair Charitable Hospital, Mumbai, Maharashtra, India

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ABSTRACT

Background: Asymmetry of abdominal muscles is a potential cause for lowback pain. Most studies assume the rotational strength towards non dominant side to be more but no studies have been conducted to objectively measure the asymmetry. In subjects with spinal deformity like scoliosis which has a rotational component to it, it can be presumed that there could be asymmetry between the oblique force couplehowever this study aims to find out whether this asymmetry exists in normal healthy individuals. By using manual muscle testing for assessing oblique muscle strength only gross asymmetry can be detected. Therefore there is a need for more objective measure to detect subtle discrepancies within strength of both sides.

Objective: The objective of this study is to measure the strength of external and internal oblique on both side using handheld dynamometer and to compare the strength on both sides.

Methodology:30 healthy young individuals in the age group of 18-30 years were selected to participate in the study. All subjects were right hand dominant.External oblique and internal oblique muscle strength was measured in KGs using a Jamartypeofhydraulichandhelddynamometer.

Results: There was a significant difference between the strength of external obliques on right and left side with strength on right side being more whereas there was no significant difference between strength of internal oblique between right and left side.

Key Words: Oblique Muscle Strength, Handheld Dynamometer, Oblique Muscle Strength Asymmetry

INTRODUCTION

The core is defined as an anatomical box which consists of several muscle groups, such as the rectus abdominis at the front, the internal and external oblique on the lateral sides, the erector spinae, lumbar multifidus, quadratus lumborum at the back, the diaphragm at the upper edge and the pelvic floor, and the iliac psoas at the bottom. Transversus abdominis, lumbar multifidus, and quadratus lumborum are considered key core muscles by health professionals while assessing and treating patients.[1]

The internal oblique of ipsilateral side and external oblique of contralateral side form a force couple to rotate the trunk. Acting unilaterally, they perform rotation. Anterior fibers of external oblique working bilaterally flex the verterbral column,support and compress the abdominal viscera, depress the

Corresponding author: Bharati Asgaonkar, Associate Professor, Physiotherapy School and Centre, TNMC & BYL Nair Charitable Hospital, Mumbai, Maharashtra, India

E-mail: bharatiasgaonkar@tnmc.edu.in

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thorax and assist in respiration. Lateral fibers of external oblique work bilaterally to tilt the pelvis posteriorly. Lower anterior fibers of internal oblique compress and support the lower abdominal viscera. Upper anterior and lateral fibers of internal oblique depress the thorax. Therefore, apart from rotation they support the viscera, depress the thorax to provide stability for action of primary flexors of trunk.[2]

In previous studies, it was noted that multifidus muscles of patients with unilateral low backpain are asymmetric and it is thinner on the painful side.[3] Also a clinical relationship was found between transverse abdominis muscle and lumbar multifidus muscle in patients with low backpain hence asymmetry of abdominal muscle can be a probable cause of low backpain.[4] Chronic low backpain patients have been seen to have significantly lower Transverse abdominis muscle thickness. Also, the transversus abdominis asymmetry was higher in chronic low backpain patients.[5]As both external and internal oblique are a part of core muscle. Their weakness and asymmetry in strength could also be a potential cause of low back pain. In addition, a subject with strong external oblique on one side on posture evaluation will have thorax extended and rotated on the stronger side due to posterolateral fibers of external oblique [1] but in this case the conventional assessment would include assessing tightness of thoracolumbar fascia and assessment of scoliosis but the root issue may remain unaddressed until the asymmetry between the strength of external oblique is assessed. Moreover, it is proven that asymmetry of abdominal muscles is a more relevant and important factor than absolute values of abdominal muscles activity.[6]

Most studies have assumed the rotational strength towards non-dominant side to be more since due to functional activities the dominant side is in a more forward plane but no studies have objectively measured the difference between the muscles of both sides. Manual muscle testing which is generally used to test the strength of muscles is a subjective measure. Also, the manual muscle testing of abdominal muscles is based on attaining different postures using upper extremity and then performing the arc of motion which becomes purely observational and does not give examiner an opportunity to feel the muscular effort. Therefore, these subtle asymmetries between the strength of oblique muscles on both sides are not assessed routinely in clinical setting as no objective measure is available to detect them.

There is limited literature assessing oblique muscles while analysing core muscle strength even when apart from trunk rotation they work synergistically with recti to flatten lumbar lordosis, raising lower leg in supine position, internal obliques contract during forward rotation of pelvis during gait.[2] There are ample of studies on transverse abdominis effect on segmental stability of spine and posture.[7-9] By using manual muscle testing for assessing oblique muscle strength only gross asymmetry can be detected. Therefore there is a need for more objective measure to detect subtle discrepancies within strength of both sides.

MATERIAL and METHODOLOGY

30 Young healthy individuals in the age group 18-30 years were selected to participate in the study after obtaining approval from ethic committee and informed consent from the participant. All subjects were right hand dominant. Both male and female subjects were included. Individuals with spinal deformity, backpain and left hand dominance were excluded from the study.

TESTING OF EXTERNAL OBLIQUE MUSCLE STRENGTH

1. Starting position of subject was supine position with oppo site hip knee flexed, arms across the chest.
2. First the patient was instructed about the movement that is to beperformed. Subject was asked to flex and rotate the trunk so that shoulder of the side to be tested is directed towards the iliaccrest of opposite side.
3. Scapulaon the side to be tested completely cleared the table.
4. Lower thoracic region remained in contact with the table.
5. Midpointbetweenmedial end of clavi clean danterior axillary border was marked.

Similarly mark midpoint of dynamometer was marked. Subject was asked to attain the explained position. Midpoint of Dynamometer was placedon the marked point and subject was asked to resist force towards opposite side (isometric work). Subject was encouraged to give hismaximum effort for10 seconds which will be measured by a stop watch.

6. Participantwasinstructednottoholdbreath.
7. Two readings were taken, best between both the readings was considered.

Fortesting Ofinternal Oblique

1. Starting position was supine with same side hip knee flexed and foot resting onplinth. For testing of left internal oblique subject was asked to raise and rotate the left hemipelvis towards the right shoulder. The lower extremity remained relaxed.Thesubjectwas instructed to not to pushfrom their heels.
2. Subject was asked to attain the explained position and a point midway betweenASIS and pubic symphysis was marked. The midpoint of dynamometer wasplacedonthispoint.
3. Subject was asked to resist force towards opposite side (isometric work). Subjectwas be encouraged to give his maximum effort for 10 seconds which was measured by a stopwatch. 4).Participant was instructed not to hold breath. Two readings were taken, best between both the readings was considered.

Statistical Analysis

The data was an a lysedusing Graph Pad Prism 9.2.0 software (1st August 2021). Data was first assessed for normality using the Kolmogorov-Smirnov test. For the datawhich passed the normality, Paired t test was used for comparison between the twoSides. For the data which did not pass normality, Wilcoxon matched pairs signed-ranktest was usedforcomparison between twosides. Theconfidenceintervalwassetas95% andsignificancelevelwassetas0.05.Thedatawasconsidered as significant if$p<0.05$.

Fig. 1: Midpoint of Dynamometer marked

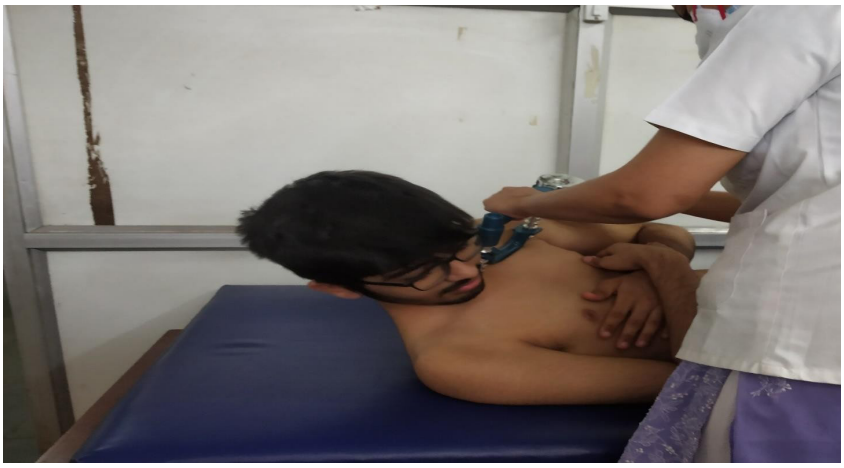

Fig. 2: Testing of Left external oblique strength using clavicle as the landmark.

Fig. 3: Testing of Right Internal Oblique Strength.

RESULT

Table 1: Demographic data (gender) of subjects.

Gender	Numberof Participants	Percentage
Females	**19**	**63%**
Males	**11**	**37%**

Table 2: DescriptiveStatisticsofMuscleStrength.

	Right external oblique	Left external oblique	Right internal oblique	Left internal oblique
MEDIAN	7	6.5	5	5
MEAN	7.16	6.7	5.13	5.06
STANDARD DEVIATION	1.234	1.418	1.252	1.437

Comparison between the external oblique strength on right and left side

Column B vs. Column A	Left vs. Right
Wilcoxon matched-pairs signed rank test	
Pvalue	**0.0258**
ExactorapproximatePvalue?	**Exact**
Pvaluesummary	********
Significantlydifferent(P<0.05)?	**Yes**
One-ortwo-tailedPvalue?	**Two-tailed**
Sum of positive, negative ranks	**40.000, -150.00**
Sumofsignedranks(W)	**-110.00**
Numberofpairs	**30**
Median	**0**

Table 3: Comparison of outcome measures between the external oblique of right and left side.

- Wilcoxon matched-pairs signed rank test for comparison of outcome measures between External Oblique of Right And Left Side. The p value was found tobe 0.0258 (i.e.<0.05) which shows statistically significant difference between the two sides.

Comparison Between the Internal oblique Strength on Right and Left Side

Table 4: Comparison of outcome measures between the internal oblique of right and left side.

Column B vs. Column A	Left vs. Right
Wilcoxon matched-pairs signed rank test	
Pvalue	**0.7002**
Exactor approximate P value?	**Exact**
Pvalue summary	********
Significantly different (P<0.05)?	**No**
One-or two-tailed P value?	**Two-tailed**
Sum of positive, negative ranks	**37.500, -28.500**
Sum of signed ranks (W)	**9.000**
Number of pairs	**30**
Median	**0**

- Wilcoxon matched-pairs signed rank test for comparison of outcome measures between Internal Oblique of Right and Left

Side. The p value was found tobe 0.7002 (i.e.>0.05) which shows no statistically Significant difference between the two sides.

RESULT AND DISCUSSION

The objective of the present study was to determine the difference in strength between external oblique of right and left side, internal oblique of right and left side.

Subjects participating in the present study were between the age group of 18-30 years, with the mean age of 22.9 years. Total 30 Healthy young individuals agreed to participate in the study and met the inclusion criteria. Out of which, 63% were female and 37% were male. There was a female predominance in our study. All Participants enrolled in the study were right-handed individuals in order to remove the confounding factor of Hand dominance and since right handedness is the predominant trait in population. Also, a study by Paul et al reported that consideration of hand dominance was an important factor while studying response time and fatigability of erector spinae and multifidis.[11]

The study concluded that there is significant difference between the strength of external obliques on right and left side with mean Strength of 7.1 KGs on right side and 6.7 KGS on left side whereas there was no significant difference between strength of internal oblique between right and left side with mean strength of 5.17 KGs on right side and 5.06 KGs on left side. The results of this study are in accordance with the study performed by Rankin et al where Ultrasonographic measures of thickness of lateral abdominal muscles was done. There was symmetry for total absolute thickness of Transverse abdominis, external and internal obliques but for individual muscles there was asymmetry of absolute size.[12]

Also, Park et al studied Ultrasound images of lateral abdominal muscles in healthy subjects while performing abdominal bracing at 50% and 100% contraction. Only Right-handed individuals were recruited. No significant difference was seen at rest and 50 % contraction However significant difference was seen at 100% contraction for external and internal oblique with thickness on right side being more.[13] External oblique was found to be thicker on dominant side which is in accordance with present study but internal oblique asymmetry was also found. Since the study required the participants to perform bracing at the abdomen which is not specific to obliques action. Ultrasonographic measurements are superior in measuring the precise thickness but may not predict functional strength of muscles as the muscle is not required to perform its action.

Paul et al investigated whether any cortical asymmetry exists between abdominal and limb muscles. He studied internal oblique, Deltoid and first dorsal interosseus in 10 healthy subjects. 3 subjects were left hand dominant. Transcranial magnetic stimulation was given to both left and right motor cortex and motor evoked potentials were recorded from the 3 muscles by EMG electrodes. Results showed that internal oblique had a strong ipsilateral component to it.[14] The subjects who revealed left side bias were mostly right handed. Subjects with right bias were left and right handed both equally because 3 right handed subjects were not assessed due to technical errors. Therefore, opposite side cortical bias was seen for internal oblique in relation to hand dominance. Therefore asymmetry was seen in internal oblique which is not in line with our study however electrical activity of muscles were noted and not strength.

Axial Rotation of trunk is a common functional activity usually attributed to be one of the risk factors in back pain. Various studies have been done to assess asymmetry in abdominal muscles in athletes practicing asymmetrical sports like fast bowling. Axial rotation as a functional activity becomes asymmetrical in daily activities due to hand dominance. The study focused to find out whether the functional asymmetrical tasks could also cause difference in strengths between the two sides. In the present study,significant difference was found in strength of external oblique with the strength on right side being more while no difference was found in internal oblique strength. This could be since external oblique is a part of outer core and is a torque producing muscle while internal oblique is a stabilizing muscle. The torque producing external oblique functions as

mobility muscle on the base of stability muscle i.e internal oblique therefore external obliques would be performing rotations towards the non dominant side as daily activities are performed. Internal obliques on the other hand may contract simultaneously on both sides to provide stability for this action.

In contrast, in a study by Gray J et al, Ultra sono graphic measurements of lateral abdominal muscles were done in 25 adolescent cricket fast bowlers, of which 16 experienced chronic low back pain while 9 were asymptomatic. Asymptomatic individuals showed increased thickness of internal oblique, external oblique and transverse abdominis on non-dominant side.[15]Internal oblique asymmetry is also seen in this population due to high force generation by dominant extremity while bowling which requires additional muscle activation in order to avoid torsional stress on lumbar spine. Bowlers with backpain were more symmetrical than without backpain. Therefore, asymmetry is a needed adaptation in this population. Interestingly, in a prospective study by Linek et al on adolescent soccer players, ultrasound images were recorded for internal oblique, external oblique and transversus abdominis at the end of expiration. In a 6 month observation period subjects who developed lowback pain were those who had internal oblique asymmetry[16] initially. In soccer, symmetrical activation of core is required for the athlete to be more agile and have better performance. Therefore, internal oblique asymmetry in soccer player was not a sports specific demand. Hence, physical activity of the normal healthy subjects is an important Factor to be kept in mind while studying muscle strength on both sides. In the present study, no subjects were involved in recreational sports.

Butler et al studied electromyographic activity of back and abdominal muscle activation while lifting object with dominant and non-dominant extremity in Right handedindividuals. No difference was found for activation of back muscles depending on whether lifts were done from right or left hand. However activation of external oblique changed depending on the hand that performed the lift. There was a greater activation of right sided external oblique while performing lifts from left hand in comparison to activation of left side external oblique while performing lifts from right hand.[17] Therefore, a handedness effect was seen for external oblique which is in line with finding of our study. However muscle activity pattern was studied in this study and not muscle strength.

CONCLUSION

1. There is a significant difference between the strength of external oblique on left and right side, with the strength of right external being more.
2. There is no significant difference between the strength of internal oblique of left and right side.

CONFLICT OF INTEREST: None.

SOURCE OF FUNDING: None

DECLARATION: The content in the manuscript has not been previously published and is not being concurrently submitted elsewhere.

ETHICAL CLEARANCE: Ethical clearance was given by the institutional ethics committee (IEC) of TNMC & BYL Nair Ch Hospital.

REFERENCES

1. Oliva-Lozano JM, Muyor JM. Core muscle activity during physical fitness exercises: A systematic review. International journal of environmental research and public health. 2020 Jan;17(12):4306.
2. Florence PK, Elizabeth KM, Patricia GP, Mary MR, William AR. Muscles Testing And Function With Posture And Pain. Fifth Edition.
3. MacDonald D, Moseley LG, Hodges PW. Why do some patients keep hurting their back? Evidence of ongoing back muscle dysfunction during remission from recurrent backpain. Pain. 2009; 142(3):183–8.
4. Hides J, Stanton W, Dilani Mendis M, Sexton M. The Relationship Of Transversus Abdominis And Lumbar Multifidus Clinical Muscle Tests In Patients With Chronic Low Back Pain. Manual Therapy. 2011; 16(6):573–7.
5. Ota M, Kaneoka K. Differences In Abdominal Muscle Thicknesses Between Chronic Low Back Pain Patients And Healthy Subjects. Journal Of Physical Therapy Science. 2011; 23(6):855–8.
6. Sidhu J. Why does back pain recur? New research findings and treatment considerations. Dynamic Chiropractic. 2011;29(6)
7. Critchley DJ, Coutts FJ. Abdominal Muscle Function In Chronic Low Back Pain Patients. Physiotherapy. 2002;

88(6):322–32.

8. Ota M, Kaneoka K. Differences In Abdominal Muscle Thicknesses Between Chronic Low Back Pain Patients And Healthy Subjects. Journal Of Physical Therapy Science. 2011; 23(6):855–8.
9. Roddy TS, BrizzolaraKJ,.Cook KF. Side To Side Differences In Transverse Abdominus Muscle (Tra) Measured By Real Time Ultrasound In Persons With And Without Chronic Low Back Pain (CLBP). Orthopaedic Physical Therapy. 2007; 20(2):56-9.
10. Kim DK, Kim CY, Lee BK, Seo D. A comparison of ultrasonography measurement on the abdominal muscle thickness between adolescent idiopathic scoliosis and healthy subjects. Journal of back and musculoskeletal rehabilitation. 2018 Jan 1;31(1):65-74.4
11. Sung PS, Spratt KF, Wilder DG. A possible methodological flaw in comparing dominant and nondominant sided lumbar spine muscle responses without simultaneously considering hand dominance. Spine. 2004 Sep 1;29(17):1914-22.
12. Rankin G Stokes M, Newham DJ. Abdominal Muscle Size And Symmetry In Normal Subjects. Muscle And Nerve: Official Journal Of The American Association Of Electrodiagnostic Medicine. 2006 Sep;(3):320-6.
13. Park SH, Song MY, Park HJ, Park JH, Bae HY, Lim DS. Effects Of Different Types Of Contraction In Abdominal Bracing On The Asymmetry Of Left And Right Abdominal Muscles. Journal Of Physical Therapy Science. 2014;26(12):1843-5.
14. Strutton PH, Beith ID, Theodorou S, Catley M, Mcgregor AH, Davey NJ. Corticospinal Activation Of Internal Oblique Muscle Has A Strong Ipsilateral Component And Can Be Lateralised In Man. Experimental Brain Research. 2004 Oct 1;158(4):474-9.j
15. Hides J, Stanton W, Freke M, Wilson S, McMahon S, Richardson C. MRI study of the size, symmetry and function of the trunk muscles among elite cricketers with and without low back pain. British journal of sports medicine. 2008 Oct 1;42(10):809-13.
16. Linek P, Noormohammadpour P, Mansournia Ma, Wolny T, Sikora D. Morphological Changes Of The Lateral Abdominal Muscles In Adolescent Soccer Players With Low Back Pain: A Prospective Cohort Study. Journal Of Sport And Health Science. 2018 Mar.
17. Butler HL, Hubley-Kozey CL, Kozey JW. Activation amplitude patterns do not change for back muscles but are altered for abdominal muscles between dominant and non-dominant hands during one-handed lifts. European journal of applied physiology. 2009 May;106(1): 95-104.

Comparative study

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Comparison of Development of Upper Trapezius Trigger Point in Computer Operators with or without Fore arm support

[1]Dnyaneshwari K. Bhongade, [2]Amrita Sakharwade

[1]Student, Shri K. R. Pandav College of Physiotherapy, Bhandara,.[2]Assistant Professor, Department of Musculoskeletal Physiotherapy, Shri K. R. Pandav College of Physiotherapy, Bhandara.

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ABSTRACT

Background: Computer work often involves both physical and mental demands. The physical demands are characterized by low-force exertions and static postures that are sustained for long durations. Elevated shoulder postures, prolonged static contractions and the task duration have been identified as computer-related risk factors for neck and shoulderproblems, so this is responsible for development of trigger points particularly in the upper trapezius muscles in forearm-unsupported computer operators as compared to forearm-supported.The upper trapezius (UT)is designated as a postural muscle and is highly suspected ofoveruse because it works constantly against gravity to maintain an erect head and neck position. This studyaims to identify upper trapezius trigger points (TrPs) developed with or without forearm support (FS) in computer operators.

Materials and Methods: The study took place in the worksite of computer operators in Nagpur,Maharashtra for 1.5 year. With a power of 90 and significance error of 1%, a total of 40 patients were taken according to the convenient sampling and divided into two categories computer operators Group A: with FS and Group B: without FS, following signs and symptoms like Trigger point,posterolateral neck and upper back painmost common in which groupassessed by using, VAS (Visual Analogue Scale) for measuring pain intensity, Trigger Point Rating Scale is used for myofascial screening. Neck Disability Index for assessing the neck-related disability due to pain taken.

Result: The study was conducted on 40 people, in which 20 people with forearm support and 20 people with forearm unsupported. The result is that forearm support reduces the load on the UTand also reduces the risk of development of upper trapezius TrPs as compared to the forearm unsupported.

Conclusion: Based on the results of these studies, it has been concluded that the development of UT TrPsin computer operators without FS is more common as compared to FS.

Keywords: MTrPs (Myofascial trigger point), Trigger point rating scale, VAS (Visual analogue scale), NDI (Neck disability index)

INTRODUCTION

Myofascial Trigger Point MTrPs (Clinical definition of a Central trigger point): A hyperirritable spot in skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band. The spot is painful on compression and gives rise tocharacteristics of referred pain, referred tenderness, motor dysfunction and autonomic phenomena.[1]

TrPsare divided into two categories: Active and latent Trigger points. Latent TrPsdo not cause local or referred pain until direct pressure is applied. They do not cause persistent Pain; however, they restrict movement, induce early Fatigue and cause loss of tissue. Active TrpsCause persistent pain even without direct manual pressure. It can result in movement

Corresponding author: Amrita Sakharwade Assistant Professor, Department of Musculoskeletal Physiotherapy, Shri K. R. Pandav College of Physiotherapy, Bhandara.

Email: amritasakharwade17@gmail.com

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restriction and in turns may reduce muscle strength, activity and tonocity. Latent TrPs may spontaneously beme active.

TrPsare divided into two categories: Active and latent Trigger points. Latent TrPsdo not cause local or referred pain until direct pressure is applied. They do not cause persistent Pain; however, they restrict movement, induce early Fatigue and cause loss of tissue. Active TrpsCause persistent pain even without direct manual pressure. It can result in movement restriction and in turns may reduce muscle strength, activity and tonocity. Latent TrPs may spontaneously beme active.MTrPs (etiological definition of a central trigger point): A cluster of electrically active loci each of which is associated with a contraction knot and a dysfunctional motor end plate in skeletal muscle.[1]

Jump sign: A general pain response of the patient, who winces, may cry out, and may withdraw in response to pressure applied on a trigger point. This term has been used erroneously to describe the local twitch response of muscle fibres to trigger stimulation.[1]

Simons et al 2 hypothesised that palpable taut bands in the affected muscles are due to excessive acetylcholine release at the neuromuscular junction (motor endplate). In this situation, continuous contraction of the muscle fibres, which is accompanied by increased metabolism and local ischaemia leads to increased secretion of sensitising substances and can subsequently cause pain and autonomic reactions such as increased sweating, vasoconstriction or vasodilation, and pilomotor activity in the muscle.[3,4]

Some chemical changes, such asincreased levels of bradykinin, substance P, and calcitonin gene-related peptide and lowered pH, have been reported in MTrPs. Investigators established that the local oxygen saturation at an MTrP site is less than 5% of normal. Hypoxia leads to a drop in tissue pH and the release of Several nociceptive chemicals, including bradykinin, calcitonin gene-related peptide, and substance P. Local tenderness and referred pain is common with MTrPs as muscle nociceptors are stimulated in response to reduced oxygen levels lowered pH and increased inflammatory chemicals. Histologic studies have confirmed the presence of extreme sarcomere contractions, resulting in localized tissue hypoxia.[5,6]

MTrPs are most commonly found in the upper trapezius (UT) muscle.[7]

UT is designated as a postural muscle and is highly suspected ofoveruse[8] because it works constantly against gravity to maintain an erect head and neck position.[9] Any TrPs in the upper trapezius can cause neck stiffness, restricted cervical rotation and lateral flexion, shoulder elevation, neck pain and headache.[10]

Computer work involves physical demands, and physical demands of a job increase sustained muscle tension, particularly in the trapezius muscles such as developed myofascial pain syndrome.[11]

While doing work with the forearm support it generally reduces the load on the trapezius muscle, whichdecreases the risk of development of UT TrPs. While doing work with forearm un-support it enhances the risk of development of upper trapezius TrPs.[12]

Upper trapezius TrPs consistently refer pain unilaterally upward along the posterolateral aspect of the neck to the mastoid process and are a major source of “tension neckache”. When referred pain from upper trapezius TrPs in other muscles (namely the sternocleidomastoid, Suboccipital and temporalis muscles), the resulting overlap can produce a typical tension-type headache.[1]

MATERIALS AND METHOD

The study took place in the worksite of computer operators in Nagpur, Maharashtra for 1.5 year. With a power of 90 and a significance error of 1%,a total of 40 patients were taken according to the convenient sampling and divided into two categories of computer operators Group A: with FSand Group B: without FS.

Inclusion criteria: Patients do work for >6 hours,work with forearm support and unsupport and those who work for prolongedperiods without an interval.

Exclusion criteria:patients who recently got soft tissue injury due to trauma or another cause, have hypersensitive skin, are not willing to participate and have working experience of <6 months.

Following signs and symptoms like Trigger point, posterolateral neck and upper back pain most common in which groups for thesethe outcome measure used wasthe Visual analogue scale [ICC = 0.97(0.96 to 0.98)] [13]for measuring intensity of pain, Trigger point rating scale [ICC = 0.7 to 0.96] [11]is used for myofascial screening and neck disability index [ICC = 0.88; (0.63 to 0.95)] [14]for assessing the neck-related disability due to pain.

FINDING

The study was conducted on 40 people, of which 20 peoplewere of forearm support and 20 of forearm unsupported (FUS) computer operators. The result shows that forearm support (FS) reduces the load on the UT and also reduces the risk of development of upper trapezius TrPsas compared to the forearm unsupported.

The evaluation is done by using the Trigger Point Rating Scale, Visual Analogue Scale and Neck Disability Index.

When we compared Table 1 and Table 2 Trigger Point Rating Scale of forearm support versus forearm unsupported,the minimum value recorded was 0.0 score in forearm support and 0.1 score in forearm unsupported while the maximum score recorded 5.0 in both the parameters. When we compared with the statistical analysis by using an unpaired T-test mean value of the Trigger Point Rating Scale versus forearm support was noted to be 1.2±1.3 while in the forearm unsupported it was 3.4±1.1, When it said the statistically significant difference was observed with the P value = <0.0001 hence it is statistically significant. It is noted that the Trigger Point Rating Scale value has increased in Forearm unsupported significantly as compared to forearm support,as shown in Table 1 and Table 2.

Table 1: Data of forearm-supported computer operators

Forearm Support						
	Age	**working hours**	**work experience**	**trigger point rating scale**	**VAS**	**NDI**
Number of values	20	20	20	20	20	20
Minimum	23	8.0	2.0	0.0	0.0	0.0
25% Percentile	31	8.0	5.3	0.0	0.0	0.0
Median	37	8.0	8.5	1.0	2.0	0.0
75% Percentile	55	9.8	26	1.8	3.8	3.0
Maximum	60	13	39	5.0	7.0	17
Mean	41	9.0	14	1.2	2.3	2.5
Std. Deviation	12	1.6	12	1.3	2.1	4.5
Std. Error	2.7	0.36	2.8	0.29	0.48	1.0

Table 2: Data of forearm unsupported computer operators

Forearm Unsupported						
	Age	**working hours**	**work experience**	**trigger point rating scale**	**VAS**	**NDI**
Number of values	20	20	20	20	20	20
Minimum	19	6.0	2.0	1.0	0.0	1.0
25% Percentile	34	8.0	6.3	3.0	5.0	2.0
Median	39	8.0	9.5	3.5	5.0	7.0
75% Percentile	43	8.8	18	4.0	7.8	11
Maximum	58	13	33	5.0	8.0	19
Mean	39	8.3	13	3.4	5.7	7.1
Std. Deviation	9.5	1.5	9.6	1.1	2.0	5.3
Std. Error	2.1	0.33	2.2	0.26	0.45	1.2

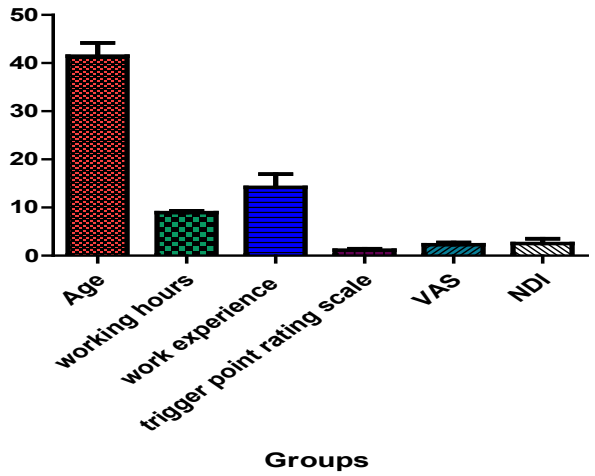

Fig 1: Graphical representation of fore arm-supported computer operators based on outcome measures

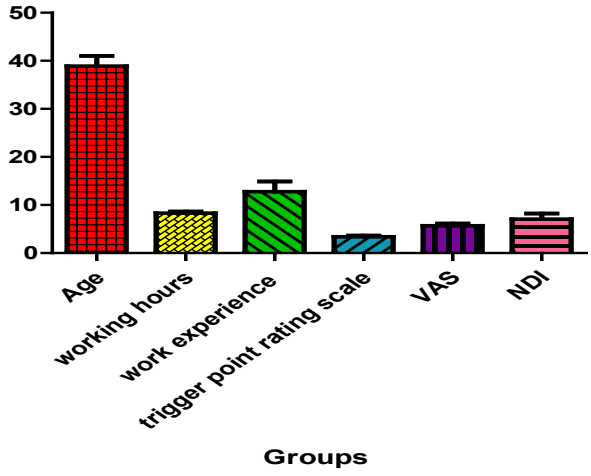

Fig 2: Graphicalrepresentation of forearm un-supported computer operators based on outcome measures.

Table 1shows that forearm-supported computer operators are evaluated with a mean age of 41±12 years, with mean working hours of 9±1.6 hours and the mean work experience of 14±12 years. Table 2shows that forearm-unsupported operators are evaluated with a mean age of 39±9.5 years, with mean working hours of 8.3±1.5 hours and a mean work experience of 13±9.6 years.

DISCUSSION

This study showed that TrPs can develop in the UT during the type of low exertions found in computer work. It was expected that high postural demands would lead to the development of trigger points due to working tasks that involve continuous arm movements always generating a static load component on these muscles, the principal muscle to carry this load is the trapezius [11]. The result shows that the development of upper trapezius trigger point in computer operators in forearm unsupported is common as compared to forearm support. However, the unsupported condition increases the load on the upper trapezius muscle, which can lead to a sustained increase in tension or over-contraction of the upper trapezius muscles. In the supported condition there is reduces the load on the upper trapezius muscles also reduces the discomfort.

The aetiology of myofascial trigger pointsare discussed with a detailed and comprehensive review of the most common mechanics, including low-level muscle contractions, uneven intramuscular pressure distribution, direct trauma, unaccustomed eccentric contractions, eccentric contractions in unconditioned muscle and maximal or submaximal concentric contractions.[15]

The evaluation of trigger points by using the Trigger Point Rating Scale, pain threshold by Visual Analogue Scale and Neck Disability Index to find out whether there is a presence of neck disability due to trigger point.

The studies found in the literature did not investigate the development of upper trapezius trigger points in computer operators without forearm support. Besides this, few studies have examined muscle activity at different angles of arm flexion and abduction. Some studies identified increased muscle activity in the upper trapezius and anterior deltoid muscles due to the increased angles in unsupported conditions and other studies also identified effect of forearm support and shoulder posture on the upper trapezius and anterior deltoid activity.

Some studies assessed muscle activity while using the forearm support and wrist in computer users and also showed decreased activation with the use of forearm support.

The result of this study indicates that the forearm support decreased the upper trapezius

load and also reduced the risk of development of the upper trapezius trigger point.

These results highlight the importance of ergonomic interventions to minimize neck/ shoulder muscle activation. In addition, the result allows us to suggest the design of future studies, with a longitudinal design, with the evaluation of the use of forearm support during the work to verify its effect on reducing the risk of musculoskeletal disorders and also design future studies on the importance of the ergonomic advice in the same condition[16].

Thus, a practical and ergonomic suggestion to reduce muscle work for people while keeping your arm close by your side. Hold your elbow at 100° to 110° angle. Keep your wrist in a straight or neutral position. Light supporting your forearm on your desk

CONCLUSION

Based on the results of these studies it has been concluded that the development of upper trapezius trigger points in computer operators without forearm support is more common as compared to forearm support.

Conflict of interest: None

Source of Funding: Self

Ethical Clearance: Taken from the ethics committee for research related to human beings of the center where the investigation was conducted.

REFERENCES

1. Travell JG, Simons DG. Myofascial pain and dysfunction: the trigger point manual. Lippincott Williams & Wilkins; 1992.
2. Mohamadi M, Piroozi S, Rashidi I, Hosseinifard S. Friction massage versus kinesiotaping for short-term management of latent trigger points in the upper trapezius: a randomized controlled trial. Chiropr Man Therap. 2017;25:25.
3. Dommerholt J, Huijbregts P. Myofascial Trigger Points: Pathophysiology and Evidence-Informed Diagnosis and Management: Pathophysiology and Evidence-Informed Diagnosis and Management. Jones & Bartlett Publishers; 2009 Dec 4.
4. Ge HY, Fernández-de-las-Peñas C, Arendt-Nielsen L. Sympathetic facilitation of hyperalgesia evoked from myofascial tender and trigger points in patients with unilateral shoulder pain. Clinical Neurophysiology. 2006 Jul 1;117(7):1545-50.
5. Shah JP. Integrating dry needling with new concepts of myofascial pain, muscle physiology, and sensitization. Integrative Pain Medicine: The Science and Practice of Complementary and Alternative Medicine in Pain Management. 2008:107-21.
6. Dommerholt J. Dry needling in orthopedic physical therapy practice. Orthop Phys Ther Pract. 2004;16(3): 15-20.
7. Astin JA. Why patients use alternative medicine: results of a national study. Jama. 1998 May 20;279(19): 1548-53.
8. Mitchell NS, Catenacci VA, Wyatt HR, Hill JO. Obesity: overview of an epidemic. Psychiatric clinics. 2011 Dec 1;34(4):717-32.
9. Bakr EM, Ismail NA, Mahaba HM. Impact of life style on the nutritional status of medical students at Ain Shams University. The Journal of the Egyptian Public Health Association. 2002 Jan 1;77(1-2):29-49.
10. Khan ZN, Assir MZ, Shafiq M, Jabeen A. High prevalence of preobesity and obesity among medical students of Lahore and its relation with dietary habits and physical activity. Indian journal of endocrinology and metabolism. 2016 Mar;20(2):206.
11. Treaster D, Marras W, Burr D, Sheedy J, Hart D. Myofascial trigger point development from visual and postural stressors during computer work. Journal of Electromyography and Kinesiology. 2006 Apr;16(2):115-24.
12. Gonçalves JS, Moriguchi CS, Takekawa KS, Coury HJ, de Oliveira Sato T. The effects of forearm support and shoulder posture on upper trapezius and anterior deltoid activity. Journal of physical therapy science. 2017;29(5):793-8.
13. Bijur PE, Silver W, Gallagher EJ. Reliability of the visual analog scale for measurement of acute pain. Academic emergency medicine. 2001 Dec;8(12):1153-7.
14. Young IA, Dunning J, Butts R, Mourad F, Cleland JA. Reliability, construct validity, and responsiveness of the neck disability index and numeric pain rating scale in patients with mechanical neck pain without upper extremity symptoms. Physiotherapy theory and practice. 2019 Dec 2;35(12):1328-35.
15. Dommerholt J, Bron C, Franssen J. Myofascial trigger points: an evidence-informed review. Journal of Manual & Manipulative Therapy. 2006 Oct 1;14(4):203-21.
16. Gonçalves JS, Moriguchi CS, Takekawa KS, Coury HJ, de Oliveira Sato T. The effects of forearm support and shoulder posture on upper trapezius and anterior deltoid activity. Journal of physical therapy science. 2017;29(5):793-8.
17. Kalichman L, Bulanov N, Friedman A. Effect of exams period on prevalence of Myofascial Trigger points and head posture in undergraduate students: Repeated measurements study. Journal of bodywork and movement therapies. 2017 Jan 1;21(1):11-8.

18. Lintula M, Nevala-Puranen N, Louhevaara V. Effects of Ergorest® arm supports on muscle strain and wrist positions during the use of the mouse and keyboard in work with visual display units: A work site intervention. International journal of occupational safety and ergonomics. 2001 Jan 1;7(1):103-16.
19. Bron C, Dommerholt J, Stegenga B, Wensing M, Oostendorp RA. High prevalence of shoulder girdle muscles with myofascial trigger points in patients with shoulder pain. BMC musculoskeletal disorders. 2011 Dec;12:1-2.
20. Martín-Sacristán L, Calvo-Lobo C, Pecos-Martín D, Fernández-Carnero J, Alonso-Pérez JL. Dry needling in active or latent trigger point in patients with neck pain: A randomized clinical trial. Scientific Reports. 2022 Feb 24;12(1):3188.
21. Cerezo-Téllez E, Torres-Lacomba M, Mayoral-del Moral O, Sánchez-Sánchez B, Dommerholt J, Gutiérrez-Ortega C. Prevalence of myofascial pain syndrome in chronic non-specific neck pain: a population-based cross-sectional descriptive study. Pain medicine. 2016 Dec 1;17(12):2369-77.
22. Gerber LH, Sikdar S, Armstrong K, Diao G, Heimur J, Kopecky J, Turo D, Otto P, Gebreab T, Shah J. A systematic comparison between subjects with no pain and pain associated with active myofascial trigger points. PM&R. 2013 Nov;5(11):931-8. z z

Comparative study

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Effectiveness of Myofascial Release Technique Versus Cupping Therapy on Pain and Range of Motion in College Going Students with Trapezitis

Firdosh F. Shekh [1] Rushikesh Joshi [2] , Devanshi M. Mehta[3]

[1,3]PG Scholor (Neurology & Psychosomatic Disorders) Krishna School of Physiotherapy & Rehabilitation, Kpgu, Vadodara, Gujrat, India, [2]Associate Professor (Neurology & Psychosomatic Disdorders) College of Physiotherapy, Sumandeep Vidyapeeth Deemed to be University, Vadodara, Gujrat , India.

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ABSTRACT

Background: Trapezitis is one of the common inflammatory conditions seen among college going students due to prolonged poor posture stressful neck movement. Students with Trapezitis usually complaints of pain and difficulty in activities of daily living. Myofascial release technique can be defined as a soft tissue mobilization technique that reduce trapezius spasm and ultimately pain is reduced. Cupping is ancient medical technique it is general utilise a glass cup to create suction over a painful area.

Need of study: There are few literatures or research work available on this. No comparison is done on above techniques. So, this study was done to compare both the techniques.

Objective: To compare the Myofascial Release Technique and Cupping therapy on pain intensity and neck disability index in Trapezitis among college going students.

Methodology: A total of 50 students with Trapezitis meeting the inclusion and exclusion criteria were allocated into two groups of 25 each. Group A (MFR) and Group B (Cupping) to receive 6 sessions of MFR and cupping therapy Pre and Post intervention scores of Visual analogue Scale (VAS), Cervical ROM (CROM) and Neck disability index (NDI) were measured.

Results: Data was analysed by SPSS21, t-test were applied. Statistically significant improvements were observed in both groups but more pronounced in Group B. VAS ($t = 6.3257$) $P<0.0001$. NDI ($t = 9.0547$) $P<0.0001$

Conclusion: The results suggested that cupping therapy showed better results than myofascial release in relieving Trapezitis in college going students.

Keywords: Trigger Points, Students, Myofascial Release Technique, cupping therapy, Trapezitis.

INTRODUCTION

Trapezius is a large, diamond-shaped muscle that extends from the back of the skull down to the lower part of the spine in the chest and across the width of the shoulders. The trapezius is attached to the top and back of the scapula as well as to the outer part of the clavicle. Its role is to support the neck and spine and assist with arm movement. (1)

Origin: The trapezius arises from the medial third of the superior nuchal line of the occipital bone, the external occipital protuberance, and the posterior border of the ligamentum nuchae; from the spinous processes of C7 – T12 vertebrae. The muscle is divided into three parts: descending (Upper fibers), ascending (Lower fibers) and Middle fibers.[2]

Corresponding author: Firdosh F. Shekh, PG Scholor (Neurology & Psychosomatic Disorders) Krishna School of Physiotherapy & Rehabilitation, Kpgu, Vadodara, Gujrat, India

Email: firdoshshekh1@gmail.com

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Insertion: The upper fibers are directed downward and laterally into the lateral 3rd of the clavicle; the middle fibers are directed horizontally into the acromion and the upper border of the spine of the scapula, the lowest fibers are directed upward and laterally and inserted on the medial and the spine of the scapula. [2]

Nerve Supply: Motor functions are supplied by fibers from the spinal part of the accessory nerve, sensory functions are supplied by fibers from the third and fourth cervical nerves. [2]

The term "Trapezitis" refers to inflammation of the trapezius muscle.This muscle assists with motions including shrugging shoulders and neck extensions. [3] pain generally arises due to overuse of the muscle in non-ergonomic posture, repeated motions, sitting for an extended amount of time without back support, high keyboard on desks, prolong neck bending activities like reading,tightness in the pectoralis major and minor muscles. [3]

The frequency is highest in middle age, and women are more affected than males. many studies have shown a wide range in the prevalence of neck discomfort, with mean point prevalence of 13% (range:5.9%–38.7%) and mean lifetime prevalence of 50%(range:14.2%–71.0%) [4] Muscle spasm occurs early after injury. This feels like tightness in the muscles. [5]

Myofascial release is defined as "the facilitation of mechanical, neural and psycho physiological adaptive potential as interfaced via the Myofascial system.Myofascial release that removes the fascia's excessive pressure on the pain-sensitive structure.[6]

Cupping is an ancient healing technique, whether it is performed dry or wet, in dry cupping the cup creates a mild vacuum on the skin to aggravate the subcutaneous tissues without blood being drawn. in wet cupping the cup suctions the lacerated skin to draw blood from the dermal microcirculation. Suction from cupping draws fluid into the treated area. This suction force expands and breaks open tiny blood vessels under skin. [7]

VAS, NDI and CROM are used as the outcome measures. The VAS measures the severity of acute and chronic pain.[8] NDI has been used to assess the neck discomfort. [9] ROM is basic technique used for the examination of movement [10]Upper Trapezius muscle fibers are useful in cervical Extension. 0° to 25° is normal range of cervical extension. [11]

Therefore the present study has been undertaken to compare the myofascial release techniques versus cupping therapy on upper trapezius trigger point in college going students.

AIM & OBJECTIVES

Aim: To compare the effect of myofascial release technique and cupping therapy on upper trapezius trigger point in college going students.

Objectives:

1. To determine the effect of myofascial release technique on pain intensity and neck disability index in upper trapezius trigger point in college going students.
2. To determine the effect of cupping therapy on pain intensity and neck disability index in upper trapezius trigger point in college going students.
3. To compare the Myofascial Release Technique and cupping therapy on pain intensity and neck disability index in upper trapezius trigger point in college going students.

Hypothesis:

Null hypothesis:

There is no significant difference in neck disability and pain in college going student treated with myofascial release technique and cupping therapy.

Alternate hypothesis:

There is significant difference in neck disability and pain in college going student treated with myofascial release technique and cupping therapy.

MATERIALS AND METHODOLOGY

- **Source of Data:**
  College going students (KSPR, KPGU Vadodara)

- **Study population:**
  Students with Upper trapezius trigger point
- **Sample size:**
  The Calculated Sample Size Is 60 (30 In Each Group).
- **Type of sampling:**
- Convenient sampling
- **Study design:**
  Interventional comparative study

Inclusion criteria

- Age group of 18-26 years,
- Male and Female participants
- VAS value between 4 to 7 out of 10
- Unilateral / bilateral trapezius trigger point
- Duration of the pain from 7 days to 1 month
- Participants willing to sign the written informed consent form.

Exclusion criteria

- Recent history of trauma, fracture in cervical spine/surgery, skin disease around area
- anti-inflammatory drugs
- Brachial neuralgia
- Scoliosis, torticollis, Sensory disturbance near treating part and radiculopathy/myopathy.

Procedure

A comparative study was conducted at MatrushriDavalba hospital, Varnama, Vadodara. It was conducted for duration of 6 months. Total of 50 participants had participated in the study according to inclusion and exclusion criteria.

The effectiveness of intervention was assessed before 1st session and then end of 6th sessions by using the outcome measure VAS, CROM and NDI.

Group: A

- Group A received MFR in 6th sessions given in 3 weeks. 2 sessions/week.
- Position of patient's: Sitting on a chair hand supported on table and head resting on head.
- Position of therapist: Behind the patients towards involved side.

Technique: Neck area exposed properly then ultrasonic gel was used for lubrication then

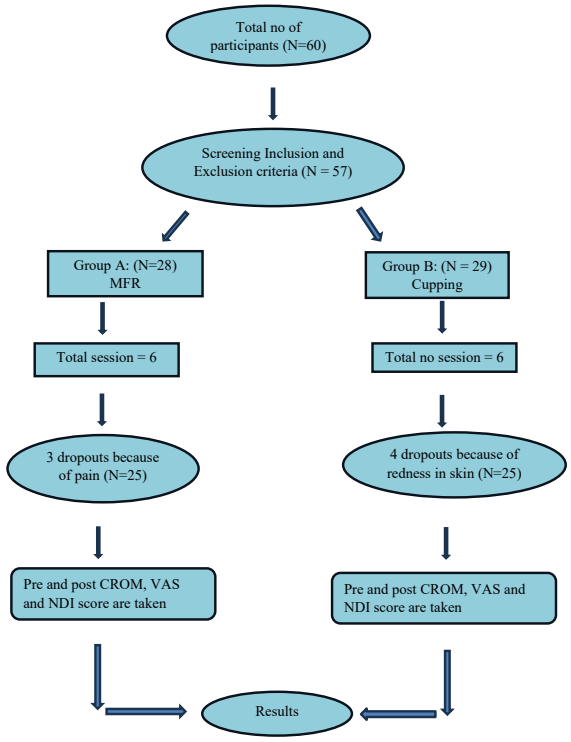


Fig. 1: Flow Chart (representing the procedure of selection of participants)

pressure was applied for 90 seconds followed by 15 sec of rest period. Repeat it for 3 times

Group: B

Group B received cupping therapy in 6 sessions given in 3 weeks. 2 sessions/week.

- Position of patient: Prone lying
- Position of therapist: Behind the patients towards involved side.

Technique: Neck area should be exposed then applying negative pressure through a suction device and moving the cup with a diameter of 4 cm on the trapezius muscle for 10 minutes. Maintaining negative pressure, the cup was massaged from the occiput to the middle of the thoracic vertebrae along the upper trapezius muscle for 5 minutes using a lubricant gel. The patient was reminded that the massage site would be red and sensitive for several days.

Outcome Variables

Visual analogue scale

It is a measurement instrument that measure the characteristics that is believed to range across a

continuum of values. A straight horizontal line of fixed 10 cm length with the ends defined as the extreme limits of the pain to be measured, oriented from left (no pain) to right (severe). The patient was asked to mark on the line, the point that they feel represents their perception of current pain. Its reproducibility has been recognized in individual subjects (ICC=0.97). [3]

Cervical Range of Motion:

All the motions were assessed by using Universal Goniometer. This test intra and interrater reliability is 0.80 to 0.93. [3]

Neck Disability Index:

Function ability was assessed on the base of neck disability index questionnaire. It is a patient - completed condition specific functional status questionnaire with 10 items. Each question is scored on a 0 to 5 rating scale, in which 0 means 'No pain' and 5 means 'Worst pain'. All the points can be summed to a total score. The test can be interpreted as a raw score of 50. Total score of these questionnaires multiply by 2 then divided by numbers of section (total section is 10) answered multiplied by 10. A score of 22% or more is considered a significant ADLs disability. [3]

Statistical analysis

Descriptive statistical analysis obtained using frequency, percentage, mean, SD. Paired t-test was used for the comparison of Pre and post data within the group. Unpaired t-test was used for the comparison of data between the groups. All the statistical analysis was performed by using IBM SPSS version 29.0.0.

RESULTS

Table 1 depicts the Comparison of mean of VAS score between groups. Mean value of VAS score Group A 3.68 ± 0.80 (p value - <0.0001) and Group B 2.04 ± 1.02 (p value - <0.0001) suggested that Group B is more significant.

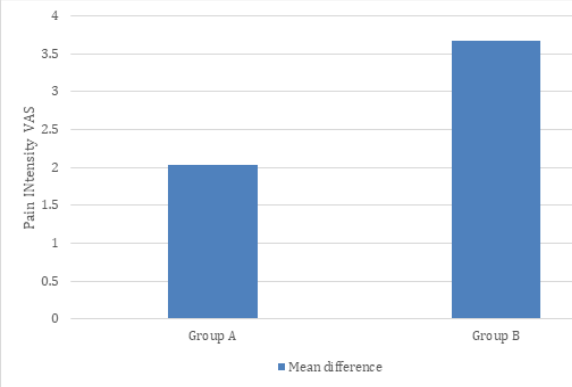
Graph 1 depicts the Comparison of mean in post intervention between the groups.

Table 2 depicts the Comparison of Post treatment mean difference values between groups of CROM were affected in both the groups, there was significant difference in mean values of CROM.

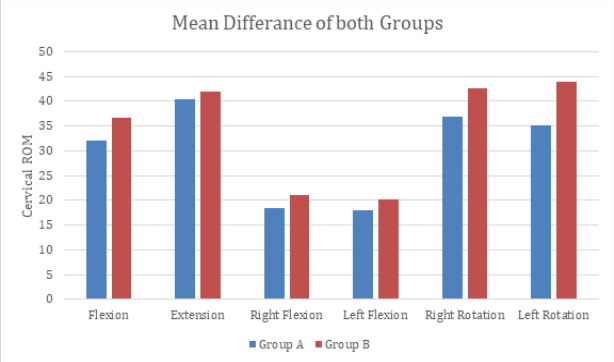
Graph 2 depicts the Comparison of mean CROM between the groups.

Table 1: Comparison of mean of VAS score between the groups

VAS	Mean ±SD	Mean ±SD	't value'	'p value'	Result
	Pre	Post			
Group A	5.44 ± 1.12	3.68 ± 0.80	7.7985	<0.0001	Extremely significant
Group B	5.44 ± 1.12	2.04 ± 1.02	10.7517	<0.0001	Extremely significant
Group A v/s group B	Group A post 3.68 ± 0.80	Group B post 2.04 ± 1.02	6.3257	<0.0001	Extremely significant



Graph 1: Mean difference VAS of both the Groups



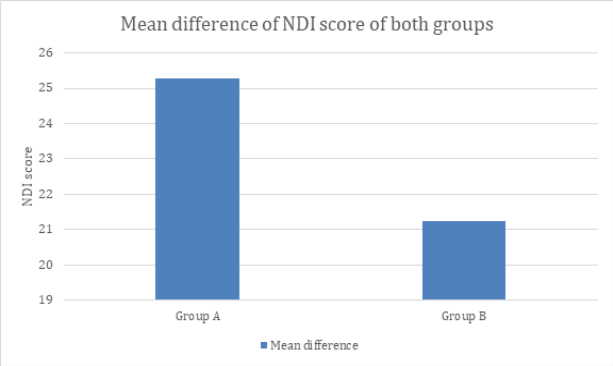
Graph 2: Comparison of mean CROM between the groups

Table 2: Comparison of Post treatment mean difference values of CROM between both the groups are as follow: Flexion: 32.04 ± 5.86 and 36.80 ± 4.70 (p-Value:<0.0027) , Extension: 40.44 ± 5.01 and 41.92 ± 4.32 (p-Value: 0.26) , Left Flexion: 17.96 ± 2.18 and 20.16 ± 1.40 (p – Value: <0.0001) , Right Flexion: 18.36 ± 2.84 and 21.12 ± 1.01 (p-Value: <0.0001) , Left Rotation: 35.12 ± 7.87 and 43.88 ± 3.79 (p -Value: <0.0001) , Right Rotation: 36.84 ± 3.75 and 42.68 ± 3.99 (p -Value : <0.0001)

CROM	Group	Mean (Difference)	SD	SEM	P value	T value	Significant
Flexion	A	32.0400	5.86	1.17	<0.0027	3.1683	Very Significant
	B	36.8000	4.70	0.94			
Extension	A	40.4400	5.01	1.00	0.2689	1.1186	Not Significant
	B	41.9200	4.32	0.86			
Right flexion	A	18.3600	2.84	0.56	<0.0001	4.5783	Extremely Significant
	B	21.1200	1.01	0.20			
Left flexion	A	17.9600	2.18	0.43	<0.0001	4.2457	Significant
	B	20.1600	1.40	0.28			
Right rotation	A	36.8400	3.75	0.75	<0.0001	5.3327	Extremely Significant
	B	42.6800	3.99	0.79			
Left rotation	A	35.1200	7.87	1.57	<0.0001	5.0143	Extremely Significant
	B	43.8800	3.79	0.75			

Table 3: Comparison of mean in post intervention between the groups using NDI where t value - 9.0547 and p value <0.001 which is statistically significant, whereas within the groups it was significant.

NDI	Mean ± SD		T value	P value	Result
	Pre	Post			
Group A	45.32 ± 7.74	25.28 ± 2.05	13.2769	<0.0001	Extremely Significant
Group B	42.32 ± 6.74	21.24 ± 0.88	15.2507	<0.0001	Extremely Significant
Group A v/s Group B	Group A post	Group B post	9.0547	<0.0001	Extremely Significant
	25.28 ± 2.05	21.24 ± 0.88			



Graph 3: Comparison of mean difference between Post NDI values between the groups

Table 3 depicts Comparison of mean in post intervention between groups using NDI. In table group A NDI score is more 22% and Group B NDI score is less than 22% That is the reason group B is more significant in pain relief.

Graph 3 depicts that Comparison of mean difference between Post NDI values between both the groups.

DISCUSSION

The present study aimed at finding out the effects of Myofascial Release Technique and cupping therapy in reducing pain on VAS scale and improving the cervical range of motion and NDI score in students with Trapezitis. The results of the present study showed that myofascial

release technique and cupping therapy both are effective techniques but cupping therapy is more effective for reducing pain, disability, and CROM among college going students with Trapezitis.

Cupping therapy has a short-term effect on increasing local hemodynamic at the upper trapezius. Clinicians can apply cupping therapy for a shorter period and maintain the same results. An increase in blood flow may be able to decrease pain and inflammation, and increase function. [12]

This finding was consistent with previous research done Emily Schultz, ATC; Noelle M. Selkow, who conducted that cupping therapy increases local subcutaneous hemodynamic at 10 minutes. Dry cupping therapy is effective in treating non-specific neck pain and improving activity of daily living andalso beneficial in decreasing pain and inflammation of Trapezitis. [12]

M. Saeidi, H. Yavari, H. R. Fateh they were conducted study that improvement of pain, disability, and fatigue in patients with trapezius pain syndrome, massage cupping should be considered as a feasible, safe, fast, and effective method for patients with trapezius pain syndrome, also, this method could be combined with other rehabilitation programs in the treatment of myofascial pain and muscle strain. [13]

Sai vispute, Niraj kumar conducted study that in which Myofascial release techniques and Positional release techniques both are effective in reducing pain intensity on VAS scale and improving cervical ROM and reducing functional disability on NDI score. [3]

The actors can be associated with the result of study.

Conclusion

In the present study, application of cupping once in 2 days for 3 weeks of trigger points in upper trapezius muscle produced significant increase in flexion, both lateral flexion and rotation of cervical spine also improvement in reducing pain measured by VAS. our study concludes that Cupping therapy is more effective in college going students with Trapezitis. So here our alternate hypothesis is accepted and our null hypothesis is rejected.

Clinically Implication

Cupping therapy is feasible, safe, fast, and effective method for patients with Trapezitis.

Limitation of the study

Small sample size, short period of intervention.

Future scope:

More sample size and long period of intervention and cupping therapy could be compared with other techniques.

Acknowledgement:

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Conflict of interest: None

Source of Funding: None

Ethical Approval:

Approval was taken by Ethical committee.

REFERENCE

1. Standring S, Ellis H, Healy J, Johnson D, Williams A, Collins P, Wigley C. Gray's anatomy: the anatomical basis of clinical practice. American journal of neuroradiology. 2005 Nov;26(10):2703.
2. Lalruatliana M, Dutta A. A Study on Effectiveness of Corrective Exercise Over Conventional Exercises in Individuals Suffering from Trapezitis. Indian Journal of Forensic Medicine & Toxicology. 2021 Jul 1;15(3).
3. Vispute S, Kumar N. A Comparative Study of Immediate Effects of Myofascial Release Technique and Positional Release Technique on Trapezitis among the College Student. Int J Physiother Res. 2022;10(3):4243-9.
4. Choksi K, Chauhan S, Jaria S, Agrawal A. Effect of Deep Transverse Friction Massage and Ischemic Compression in Trapezitis: A Randomized Controlled Trial. Indian Journal of Physiotherapy & Occupational Therapy. 2021 Jan 1;15(1).
5. Chaudhary ES, Shah N, Vyas N, Khuman R, Chavda D, Nambi G. Comparative study of myofascial release and cold pack in upper trapezius spasm. International Journal of Health Sciences & Research. 2013 Dec;3(12):20-7.
6. Sata J. A comparative study between muscle energy technique and myofascial release therapy on myofascial trigger points in upper fibres of trapezius. Indian Journal of Physiotherapy and Occupational Therapy. 2012 Jul 1;6(3):150.
7. Chirali IZ. Traditional Chinese Medicine Cupping Therapy-E-Book. Elsevier Health Sciences; 2014 Jun 27.

8. Bijur PE, Silver W, Gallagher EJ. Reliability of the visual analog scale for measurement of acute pain. Academic emergency medicine. 2001 Dec;8(12):1153-7.
9. Hoving JL, O'Leary EF, Niere KR, Green S, Buchbinder R. Validity of the neck disability index, Northwick Park neck pain questionnaire, and problem elicitation technique for measuring disability associated with whiplash-associated disorders. Pain. 2003 Apr 1;102(3):273-81.
10. Kisner C, Colby LA, Borstad J. Therapeutic exercise: foundations and techniques. Fa Davis; 2017 Oct 18.
11. Hislop HJ, Montgomery JD. Worthingham's Muscle Testing: Techniques of Manual Examination, ; Saunders.
12. Schultz E. Exploring the Hemodynamic Benefits of Cupping Therapy at the Upper Trapezius.
13. Saeidi M, Yavari H, Fateh HR. The Comparative Effects of Cupping Massage and Exercise Training in Patients with Trapezius Myofascial Syndrome on Pain, Disability, and Fatigue. A Randomized Controlled Trial. Muscles, Ligaments & Tendons Journal (MLTJ). 2021 Oct 1;11(4).

Observatnal study

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To Analyze Pilates' Impact on the Childbirth Process and its Results in Pregnant Females : Observational Study

Gunjan Shukla[1*], Namrata Srivastava[2]. Kalpana Jain[3], Kartik Chhonker[4]

[1]Professor Career College Bhopal, [2]Hod, Professor Career College [3]Associate Professor Career College Bhopal, [4]Assistant Professor Career College Bhopal.

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ABSTRACT

Background: Pilates Method as been a popular background for almost a century and is now used worldwide as a form of fitness and holistic health because it can be tailored to individual needs and fitness levels. Lucia first adevised mat exercises performed on the floor, adapting them to individual physical and temporal constraints without compromising the wider element. He later labeled a series of specialized devices, including springs and rollers, that provide resistance to develop divergent movement patterns.13

Performing exercise with medium intensity has positive effects on the maternal health.The goal of obstetric care is to provide the right conditionsfor a safe delivery and make it a pleasant experience. Labor pain is an unavoidable component ofchildbirth whose proper management, despite the greatadvances in midwifery, is still one of the major challengesrelated to women's health. Pregnant women should also be clinically evaluated before starting exercise to ensure there is no medical reason to stop exercising.

Methods: Patients were randomly divided into two groups of 15 people in each group. In the intervention group, a Pilates exercise program was developed in collaboration with a Pilates trainer. The program was tailored to the susceptibility of pregnant women and was administered twice weekly for 8 weeks.

Four tools were used in this study, including a two-part checklist, the Borg Rating of Perceived Exertion (RPE), the Visual Analogue Scale (VAS), and the McKee Childbirth Satisfaction Rating Scale. A two-section checklist was used in this study to collect the required information.

Conclusion:, According to the results of this study, Pilates exercise during pregnancy is a safe method to reduce the length of the active phase and second stage of labor, reducelabor pain, and increase maternal satisfaction with thechildbirth process. However, Pilates exercise did not significantlyreduce the need to episiotomy and caesarean section.

Keywords: PILATES METHODS(PM), VAS, RPE, Mckee childbirth satisfaction rating scale, pregnant females.

Consent:informed consent was taken from all participants in the study for the publication work in the journal.

INTRODUCTION

The World Health Organization (WHO) defines health as complete physical, mental and social well-being, not simply the absence of disease or physical, mental or moral weaknesses or deficiencies.

PM has been described as a form of mental and physical conditioning and its philosophy is to train the mind and body to work together toward overall fitness goals. It is a series of exercises or poses linked together in specific ways to increase circulation, flexibility and strengthen specific areas of the body. It has been suggested that it develops evenly, corrects improper posture, restores physical vitality, invigorates the mind, and uplifts the spirit.[14-15]

Corresponding author: Gunjan Shukla Professor Career College, Bhopal,

Email: gunjanmolly@gmail.com

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PM is designed to restore physical fitness through the development of strength, flexibility, natural grace and ability that are reflected in all aspects of life without undue physical fatigue or mental strain increase. It corrects postural imbalances, increases strength, awakens the mind and spirit, and helps improve the whole body. The mental aspect of PM is evident in the increased focus on breathing and concentration when performing movements.[16]

Pilates is considered the leading exercise for improving physical, mental and motor function. This exercise includes a series of low pressure exercises that increase strength and flexibility throughout the body. Using standard breathing techniques is very important in Pilates and helps to improve pelvic and core strength, especially the transversus abdominis muscles associated with the pelvis.[24]

METHODOLOGY

The current study was conducted in the physiotherapy department of Career Institute of Medical Science Bhopal.

Inclusion criteria

1. Age between 18-35 years
2. First and single pregnancy
3. Gestational age between 26 and 28 weeks
4. Normal body mass index.

Exclusion criteria

1. Pregnancy hyper tension and gestational diabetes
2. Prohibition to do exercise during pregnancy
3. Absence from more tan 2 sessions in the exercise program
4. Withdrawl from the study

Patients were randomly divided into two groups of 15 people in each group. In the intervention group, a Pilates exercise program was developed in collaboration with a Pilates trainer. The program was tailored to the susceptibility of pregnant women and was administered twice weekly for 8 weeks. Intervention participants were asked to choose a number between 6 and 20 that relates to the intensity of effort required to perform the exercise. Exercise started at light intensity and increased intensity after two weeks of conditioning.

In the control group, Patient received regular pregnancy counseling by phone once every 2 weeks, participated in daily activities, and did not participate in a regular exercise program. During pregnancy and Postpartum, care was provided according to hospital standard and routine protocols in both the intervention and control groups. A checklist tailored to each group studied was completed during distribution.

Four tools were used in this study, including a two-part checklist, the Borg Rating of Perceived Exertion (RPE), the Visual Analogue Scale (VAS), and the McKee Childbirth Satisfaction Rating Scale. A two-section checklist was used in this study to collect the required information. In the first section, surveyed demographic information was recorded.

Labor pain intensity was measured using a visual pain scale (VAS) consisting of a 10 cm long horizontal line with a score of 0 for no pain and a score of 10 for maximal pain. The Mackey Childbirth Satisfaction Rating Scale was used to measure maternal satisfaction with childbirth. It contained 22 items on four subscales. Hersatisfaction with maternal performance, maternal satisfaction with midwife's performance, satisfaction with infant condition, and overall satisfaction with labor and delivery experience.

DATA ANALYSIS AND RESULTS

The main aim of the present study is to examine the effect of Pilates on the childbirth process and its outcomes in pregnant females. The total subjects enrolled for the study were 30, divided into two groups of 15 subjects in group A and group B. All subjects were 18-35 years old.

The data were analysed using repeated measures of unpaired student 't' test to find the significance of interventions used within the groups and then the same test was used for the above-mentioned parameters to find the significance between both the groups.

Table No 1. The comparison of Gestational Age in control versus experimental group .

Study Group	Control Group	Experimental Group	t Value	p-Value
Gestational Age	26.30 ± 1.04	25.78±1.20	1.26	>0.05***
*p<0.001, which is considered to be highly significant **p<0.05, which is considered to be significant *** Non-Significant				

Table 2: The comparison of length of labor in control versus experimental group .

Study Group	Control Group	Experimental Group	t Value	p-Value
Lenghth of Labor	258.20± 14.24	168.07±16.46	16.03	p<0.0001*
*p<0.001, which is considered to be highly significant **p<0.05, which is considered to be significant *** Non-Significant				

DISCUSSION

The aim of this study was to investigate the effect of Pilates exercise on the outcomes of childbirth in pregnant women. According to the results of the present study, Pilates had a positive effect on the severity of labor pain in the active phase, the length of the active phase and second stage of labor, and maternal satisfaction with childbirth.[18-20] Nevertheless, there was no association between Pilates exercise during pregnancy and need to oxytocin to increase labor pain, episiotomy, type of delivery, and first- and fifth -minute Apgar scores.[20]

In a study by Perales, in contrast, physical activity during pregnancy caused the first stage to be shorter but had no effect on the length of the second stage of labor. Although in the present study Pilates did not significantly affect the need for oxytocin to augmentation of labor pain, the need for infusion of oxytocin was lower in the intervention group than that in in the control group. The results of the present study showed no effect of Pilates exercise during pregnancy on the type of delivery. Studies of Rodríguez and Sarpkaya Güder showed a statistically significant difference in the type of delivery between Pilates and control groups, with the number of normal deliveries being higher in the Pilates group.[15]

The main difference between the intervention groups was in the intensity of exercise. It seems that the evidence supporting the role of exercise in reducing the rate of primary cesarean section is due to differences in the amount of exercise. Barakat did not find any difference between the control group and active people who did only light exercise 3 days a week during pregnancy. A review and meta-analysis showed that women who did aerobic exercise for 30 to 60 min 2–7 times a week had a significantly reduced risk of caesarean delivery[23] The results of this study showed that moderate-intensity Pilates exercise twice a week alone had no effect on increasing the rate of natural childbirth in primiparous women, and that most young primiparous women had a better chance of having a normal delivery. Also, due to the cancellation of face-to-face sessions following the outbreak of the coronavirus and doing the exercises at home, it seems likely that doing exercise in the presence of a coach will yield different results.[24]

In Price and Melzer, in their study of the effect of physical activity during pregnancy on birth outcomes, found that physical activity during pregnancy had no effect on neonatal Apgar scores. This is consistent with current research. In contrast, in a study by Aktan and Sarpkaya Güder, Pilates exercise during pregnancy caused a statistically significant difference between the intervention and control groups in terms of initial and her 5-minute Apgar scores, which was consistent with the present study.[15] Inconsistent. One of the reasons Pilates does not affect Apgar scores may be due to the fact that in research

settings, caesarean sections are expedited when there are risk factors for low Apgar scores in babies. This is one of the reasons for the decrease in cases with low Apgar scores. No adverse effects on neonatal outcomes were observed in this study[16].

Consistent with the current study, a study by Sarpkaya Güder found that compared to controls, women who performed Pilates exercises during pregnancy felt safer during labor, coped better during labor, It was good overall with few issues. Satisfied with the delivery experience. Bolanthakodi's study found that practicing yoga during pregnancy made mothers happier during the birth process. Navaz[17] also showed that control of labor through exercise (without epidural) during pregnancy improved the mother's birth experience and had long-term effects on subsequent pregnancies. In our study, Pilates also influenced maternal satisfaction with childbirth. According to the results and participants, labor time was reduced, pain intensity during labor was reduced, and breathing during labor was improved. The use of and relaxation (learned in exercise sessions during pregnancy) can ultimately help ease the labor experience and increase a woman's satisfaction with the labor process[18]. .

This study had several strengths. First:One of the strengths of this study was that the selection of primiparous women prevented individual experiences of previous births from influencing the study results. Second:The lack of concomitant drugs to reduce labor pain made the role of prenatal exercise in reducing the severity of labor pain more real. Third:Cox regression analysis and Kaplan-Meier survival analysis were used to calculate total hours worked. Survival analysis is a useful technique when many confounding factors influence study results.[19] This data analysis method censors these factors. One of the limitations of current research is the deterioration of the mental status of pregnant women during exercise due to the spread of the Covid-19 virus. There are other important restrictions as well.[10]

This study included only low-risk and nulliparous pregnant women, so the current results cannot be generalized to mothers with high-risk pregnancies or multiple births. Also, the lack of exercise in the control group left the question of whether a Pilates exercise program would prove more valuable during pregnancy and childbirth compared to other sports. Finally, the results of the study could not be evaluated in women undergoing caesarean section, so an intention-to-treat analysis was not possible.

Conclusion

According to the results of this study, Pilates exerciseduring pregnancy is a safe method to reduce the lengthof the active phase and second stage of labor, reducelabor pain, and increase maternal satisfaction with thechildbirth process. However, Pilates exercise did not significantlyreduce the need to episiotomy and caesarean section. It was not possible for us to assess outcomessuch as episiotomy and duration of the active phase andsecond stage, as well as the severity of pain during laborin some mothers due to cesarean section.

Although in this study performing these exercises duringpregnancy did not cause side effects for the mother andbaby, more detailed studies with a larger sample size areneeded to prove the effectiveness and safety of this exercise during pregnancy.

Ethical clearance: this study was approved by our institutional ethical committee.

Source of funding: self

Conflict of interest: nil

REFERENCES

1. Abushaikha L, Oweis A. Labour pain experience and intensity: a Jordanian perspective. Int J Nurs Pract. 2005 Feb;11(1):33–8.
2. Navas A, Artigues C, Leiva A, Portells E, Soler A, Cladera A, et al. Effectiveness and safety of moderate-intensity aerobic water exercise during pregnancy for reducing use of epidural analgesia during labor: protocol for a randomized clinical trial. BMC Pregnancy Childbirth. 2018;18(1):94
3. Nystedt A, Högberg U, Lundman B. The negative birth experience of prolonged labour: a case–referent study. J Clin Nurs. 2005;14(5):579–86.
4. Cheng YW, Hopkins LM, Laros RK Jr, Caughey AB. Duration of the second stage of labor in multiparous women:

maternal and neonatal outcomes. Am J Obstet Gynecol. 2007;196(6):585–e1.
5. Mazzarino M, Kerr D, Morris ME. Pilates program design and health benefits for pregnant women: a practitioners' survey. J Bodyw Mov Ther. 2018;22(2): 411–7.
6. Davies GA, Wolfe LA, Mottola MF, MacKinnon C, Arsenault M-Y, Bartellas E, et al. Exercise in pregnancy and the postpartum period. Journal of obstetrics and gynaecology Canada. JOGC. 2003;25(6):516–29.
7. Obstetricians, A. C. o., & Gynecologists. Physical activity and exercise during pregnancy and the postpartum period. Committee opinion no. 650. Obstet Gynecol. 2015;126(6):e135–42.
8. Adesegun D, Cai C, Sivak A, Chari R, Davenport MH. Prenatal exercise and pre-gestational diseases: a systematic review and meta-analysis. J Obstet Gynaecol Can. 2019;41:1134–43.e17.
9. Torelli L, de Jarmy Di ZIK, Rodrigues CA, Stüpp L, Girão MJBC, Sartori MGF. Effectiveness of adding voluntary pelvic floor muscle contraction to a Pilates exercise program: an assessor-masked randomized controlled trial. Int Urogynecol J. 2016;27(11):1743–52.
10. Bø K, Herbert RD. There is not yet strong evidence that exercise regimens other than pelvic floor muscle training can reduce stress urinary incontinence in women: a systematic review. J Phys. 2013;59(3):159–68.
11. Salvesen KÅ, Mørkved S. Randomised controlled trial of pelvic floor muscle training during pregnancy. Bmj. 2004;329(7462):378–80.
12. Dilek SG. Pregnancy Pilates and Benefts of pregnancy Pilates during childbirth. J Yoga Physio. 2018;5(1):555652.
13. Bikmoradi A, Zafari A, Oshvandi K, Mazdeh M, Roshanaei G. Effect of progressive muscle relaxation on severity of pain in patients with multiple sclerosis: a randomized controlled trial. Hayat. 2014;20(1):26–37.
14. Jafari E, Mohebbi P, Rastegari L, Mazloomzadeh S. (2013). The comparison of physiologic and routine method of delivery in mother's satisfaction level in ayatollah Mosavai hospital, Zanjan, Iran. Iran J Obstet Gynecol Infertil. 2012; 16(73):9–18.
15. Rodríguez-Díaz L, Ruiz-Frutos C, Vázquez-Lara JM, Ramírez-Rodrigo J, Villaverde-Gutiérrez C, Torres-Luque G. Effectiveness of a physical activity programme based on the Pilates method in pregnancy and labour. Enfermería Clínica (English Edition). 2017;27(5):27 1–7.
16. Bolanthakodi C, Raghunandan C, Saili A, Mondal S, Saxena P. Prenatal yoga: effects on alleviation of labor pain and birth outcomes. J Altern Complement Med. 2018;24(12):1181–8.
17. Barakat R, Franco E, Perales M, López C, Mottola MF. Exercise during pregnancy is associated with a shorter duration of labor. A randomized clinical trial. Eur J Obstet Gynecol Reprod Biol. 2018;224:33–40.
18. Gehan AA, Khadiga SA, Amir GA, Eman A. Efficacy of antenatal exercises on maternal and neonatal outcomes in elderly primigravida. Kasr Al Ainy Medical Journal. 2015;21(3):109.
19. Melzer K, Schutz Y, Soehnchen N, Othenin-Girard V, de Tejada BM, Irion O, et al. Effects of recommended levels of physical activity on pregnancy outcomes. Am J Obstet Gynecol. 2010;202(3):266–e1.
20. Perales M, Calabria I, Lopez C, Franco E, Coteron J, Barakat R. Regular exercise throughout pregnancy is associated with a shorter first stage of labor. Am J Health Promot. 2016;30(3):149–57.
21. Davenport MH, Ruchat SM, Sobierajski F, Poitras VJ, Gray CE, Yoo C, et al. Impact of prenatal exercise on maternal harms, labour and delivery outcomes: a systematic review and meta-analysis. Br J Sports Med. 2019; 53(2):99–107.
22. Salvesen KÅ, Stafne SN, Eggebø TM, Mørkved S. Does regular exercise in pregnancy influence duration of labor? A secondary analysis of a randomized controlled trial. Acta Obstet Gynecol Scand. 2014;93(1): 73–9.
23. Price BB, Amini SB, Kappeler K. Exercise in pregnancy: effect on fitness and obstetric outcomes-a randomized trial. Med Sci Sports Exerc. 2012;44(12): 2263–9.
24. Barakat R, Ruiz JR, Stirling JR, Zakynthinaki M, Lucia A. Type of delivery is not affected by light resistance and toning exercise training during pregnancy: a randomized controlled trial. Am J Obstet Gynecol. 2009;201:590. e1–6.

Original Article

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Sleep In Infants –A Pilot Study In North Karnataka

Jyoti S. Jeevannavar[1], Nidhi S. Mehta[2], Esha U. Kamat[3]

[1]Professor, [2]Post Graduate Student, [3]Intern

[1-3]S. D. M. College of Physiotherapy, Shri DharmasthalaManjunatheshwara University, Dharwad, Karnataka, India.

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ABSTRACT

Background: Normal growth and development, emotional wellness, and immune function all require adequate sleep. Sleep is commonly thought to be a time when the mind and body relax and recover, but in reality, sleep is a period of significant neuronal and physiological activity. This study intends to find the prevalence of sleep disturbance in typically developing infants.

Methodology: The study included 60 participants. The parents of the participants who met the studycriteria were administered aquestionnaire including demographic details of the child and questions pertaining to the sleep behaviour of their child during the first 12 months of life. The data collected was subjected to appropriate statistical analysis.

Result: The study included 60 participants of either gender in the age group of 12-24 months. The mean birth weight of all the children was 2891.6 (±553.9) grams. The mean age of sleep development of all participants was 4.18 (±2.61) months. Pearson's correlation analysis revealed that there was no statistical significance between mother's age at delivery and birth weights or sleep development ageof children. Also,the birth weight and sleep development age of children didn't correlate with each other.A large number [50(83%)] of children developed the sleep pattern by 6 months of age, which was significant at a z-value of 7.303 at p-value of <0.00001.

Discussion: The mean birth weight of boys was higher than the girls. The boys also developed the circadian sleep wake cycle slightly later than girls. However, no significant correlation was found between birth weights and sleep development ages of children. Majority of the infants developed the sleep rhythm in first 6 months of life whereas a small proportion developed it later till 12 months of age.

Conclusion: The boysdeveloped the circadian sleep wake cycle slightly later than the girls. However,maximum children developed the sleep pattern by 6 months.

Keywords: Sleep; Infants;Sleep Behaviour; Circadian Rhythm.

INTRODUCTION

Sleep is a reversible behavioural state of reduced attentiveness and interaction with the environment. Although it is commonly believed that sleep is a time for the body and mind to relax and recover, there is actually a lot of neurological and physiological activity during sleep.The fact that infants and young children spend the majority of their time sleeping suggests that sleep is crucial for the body and brain to develop. The mean youngster has spent more time sleeping by the time they are three years old than they have in all of their wakeful activities.[1]

The circadian rhythm starts to develop at 2 to 3 months.[2] Social cues like feeding times and bedtime rituals start to affect sleep/wake patterns as well.Sleep needs lessen and sleep/wake state organisation gets better as the baby gets older. There is a consolidation of night-time

Corresponding author: Esha U. Kamat, Intern, SDM College of Physiotherapy, Dharwad, Karnataka, India.

Email: kamatesha8@gmail.com ,

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sleep, and separate naps form during the day. The longest period of uninterrupted sleep is typically 6 hours long by the time a baby is 6 months old.[3] The nocturnal sleep phase is often divided into two lengthy naps that are separated by one night-time feeding. Children normally sleep 14 to 15 hours per day by the time they turn one year, with the majority of the time spent asleep and the remaining hours taken during one to two daytime naps.[1,3]

Pre-sleep behaviours include feeding, rocking, and being held frequently co-occur with sleep onset in young infants.[4]Sleep disturbances may be due to Sleep Onset or Sleep Continuity Problems.[5]

Poor quality of night time sleep may have day time behavioural manifestations, such as poor concentration, impulsivity and over activity.[6] Sleep disturbance has been strong associated with increased risk of anxiety, speech, behavioural, attention and learning problems; depression and developmental delay.[7]

Sleep disturbances have been reported to affect the physical, emotional and cognitive development and performance significantly among children with cerebral palsy than typically developing children. Children with cerebral palsy have a higher incidents of awaking after sleep onset, initiating and maintaining sleep, sleep wake transition, sleep breathing disorders, excessive day time sleeping etc. than typically developing children.[8]

Based on previous studies, the prevalence of individual sleep disorders is 3.2% to 25.5%.[9]

Sleep has been found to influence the various aspects of development in children and also reported to influence development of children with cerebral palsy. As sleep disturbance has been strongly associated with an increased risk of developmental delay, it could be used as a predictor for early identification of any developmental issues in infants. Most of the sleep related studies reported were done in children from 4 to 10 years of age. None of the studies in infants were found during the search for review of literature. Thus, the objective of this study was to identify sleep development patterns in infants in our geographic location, so as to facilitate early identification and intervention for prevention of delays and better developmental outcomes.

METHODOLOGY

Ethical permission was obtained for the data collection relatedto the study.

Inclusion Criteria

Typically developing infants of either gender aged 12 to 24 months were included in the study.

Exclusion Criteria

Children with a known diagnosis of neurodevelopmental delay, genetic or metabolic disorders were excluded from participation in the study.

100 infants were screened for inclusion and exclusion criteria prior to participation in the study. 4 children had Down's syndrome, 6 children were not well at the time of data collection, parents of 12 children were not available (children accompanied by caretakers and/or grandparents) for data collection and18 parents did not agree for participation in the study. Thus, the data of 60 children was collected and further subjected to analysis.

RESULTS

The data of 60 children was subjected to appropriate statistical analysis using Statistical Package for Social Sciences (SPSS) Version 23.0. Descriptive analysis was done using means, standard deviations and percentages. All calculations were performed at $p<0.05$ as statistically significant.

The 60 participating children included 34 (56.6%)boys and 26 (43.3%) girlsin the age group of 12 to 24 months. The proportion of boys and girls in the study was not significantly different with a z-value of 1.4606 at p-value of 0.1.

Mean birth weight of all the children was 2891.6 (±553.9) grams with boys and girls at 2914.7(±604.0) and 2861.5(±490.7) grams respectively. The birthweightwere not significantly different with a t-value at 0.365 at a p-value of 0.7.

Table 1- Frequency Distribution of Parental Responses						
	QUESTIONS	**NV N(%)**	**OC N (%)**	**SM N (%)**	**OFT N (%)**	**AL N (%)**
1	**Resisted going to bed**	25 (41.7)	11 (18.3)	12 (20)	3 (5)	9 (15)
2	**Difficulty in falling asleep?**	42 (70)	7 (11.7)	7 (11.7)	1 (1.7)	3 (5)
3	**Jerks body parts when asleep?**	38 (63.3)	12 (20)	8 (13.3)	1 (1.7)	1 (1.7)
4	**Woke up more than twice at night?**	16 (26.7)	7 (11.7)	18 (30)	6 (10)	13 (21.7)
5	**Difficulty to fall asleep again after waking up?**	40 (66.7)	10 (16.7)	7 (11.7)	-	3 (5)
6	**Making sounds in sleep?**	46 (76.7)	5 (8.3)	5 (8.3)	3 (5)	1 (1.7)
7	**Wakes up by crying?**	33 (55)	14 (23.3)	11(18.3)	1 (1.7)	1 (1.7)
8	**Snoring?**	42 (70)	6 (10)	9 (15)	1 (1.7)	2 (3.3)
NV-Never, OC-Occasionally, SM-Sometimes, OFT- Often, AL-Always						

The mean age of sleep development of all participants was 4.18 (±2.61) months, with the boys and girls at 4.4(±2.72) and 3.9(±2.47) months respectively. The sleep development agewerenot significantly different with a t-value of 0.773 at a p-value of 0.4.

Table 1 shows that the number of responses of parents about their children's sleep. Parents of a significant number of children reported that the children woke up twice or more. Parents of children also reported that their children nevermadesounds in sleep(76.7),had any difficulty in falling asleep(70),had snoring(70),had difficulty falling asleep after waking up(66.7),had jerky movements of body parts(63.3),woke up by crying(55),resisted to going to bed (41.7),woke up more than twice(26.7).

Pearson's correlation analysis between mother's age at delivery and birth weight of the children revealed that there was no statistically significant corelation with r-value of 0.006 at p-value of 0.9.It also revealed that there was no significant correlationbetween mother's age at delivery and sleep development age of the children with r-value of-0.237 at P value of 0.07. Also, there was no significant correlation between the birth weight and the sleep development age of children withr-value of -0.034 at p-value of the proportion of children with sleep development age ≤6 [50(83%)] and 6-12 [10(17%)] months is statistically significant with az-valueof7.303 atp-value of<0.00001.

Table 2: Sleep Development Age Wise Z-Score.		
	≤ 6 months	**6-12 months**
BOYS	27	7
GIRLS	23	3
TOTAL	50	10

DISCUSSION

The gender representation of girls and boys was equal among the 60 participating children.

Mean birth weight of the boys was higher than the girls in the study, however it was not statistically significant. This result is partly supported by an article which also suggests that male children have significantly higher birth weight. The result of our study may not have been significant as the sample included was very small as compared to the other study which has reported that gender would influence the birthweight and male neonates would have a significantly higher birth weights than the female neonates.[10]

The mean age of sleep development of boys was higher than the girls in the study, however it was not statistically significant. This implies that boys developed the circadian sleep wake cycle slightly later than the girls. A study has reported that girls sleep longer and have better sleep quality than boys. It also reports that Sex differences in sleep appear in infancy and persist into childhood and adult life mediated by oestradiol which plays a role in cortical maturation and function as early as fetal life.[11]

A very weak positive correlation existed between mother's age at delivery and birth

weight of the children which was not statistically significant.This implies that as the maternal age at delivery increased the child's birth weight decreased. A number of studies have reported that child's birth weight decreased with increasing maternal age.[12-17]A very weak negative and statistically non-significant corelation existed between the sleep development age of the children and the mother's age at delivery and also the birth weight of the children.However, no articles discussing the influence of maternal age at child birth and child's birth weight on child's sleep development age were found during the search for review of literature.

It also revealed that there was no significant correlation between the birth weight and the sleep development age of children. However, no supporting or refuting articlesfor the same were found.

CONCLUSION

This is one of the very few studies reporting the sleep behaviour in infants. There are various biopsychosocial and environmental factors that influence the sleep behaviour in infants. In view of the sleep behaviour of infants in the first 12 months of infancy, this study would like to conclude that boys included in the study, developed the circadian sleep wake cycle slightly later than girls. However, there was no significant correlation found between the birth weight and the sleep development age of the participants. Also, it was noted that a very large proportion of the infants developed the circadian pattern of sleep by 6 months of age.

However, these results may not be generalised to the entire population as the sample size was small and limited to a single geographic location. The study further included only typically developing children and the various maternal psychological factors which may have influenced child behaviours were not taken into account in the study.

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REFERENCES

1. Davis KF, Parker KP, Montgomery GL. Sleep in infants and young children: Part one: normal sleep. Journal of Pediatric Health Care. 2004 Mar 1;18(2):65-71.
2. Sheldon SH. Sleep in infants and children. Sleep: A Comprehensive Handbook. Hoboken, NJ: John Wiley & Sons. 2006:507-10.
3. Davis KF, Parker KP, Montgomery GL. Sleep in infants and young children: Part one: Normal sleep. Journal of Pediatric Health Care. 2004;18(2):65–71.
4. Anders TF. Night-waking in infants during the first year of life. Pediatrics. 1979 Jun 1;63(6):860-4.
5. Sadeh A, Anders TF. Infant sleep problems: Origins, assessment, interventions. Infant mental health Journal. 1993 Mar;14(1):17-34.
6. Wiggs L. Sleep problems in children with developmental disorders. Journal of the Royal Society of Medicine. 2001;94(4):177–9. doi: 10.1177/ 014107680 109400406
7. Knobbe K, Partha M, Seckeler MD, Klewer S, Hsu C, Edgin J, et al. Association between sleep disturbances with neurodevelopmental problems and decreased health-related quality of life in children with Fontan circulation. Journal of the American Heart Association. 2021;10(21).
8. Dutt R, Roduta-Roberts M, Brown C. Sleep and children with cerebral palsy: A review of current evidence and environmental non-pharmacological interventions. Children. 2015;2(1):78–88. doi:10.3390/children2010078
9. Gupta R, Goel D, Kandpal SD, Mittal N, Dhyani M, Mittal M. Prevalence of sleep disorders among primary school children. The Indian Journal of Pediatrics. 2016 Nov;83:1232-6.
10. Prakash A, Venkatesh S, Sadagopan S, Palanisamy S. Regional gestational age and gender-specific birth weight reference charts and its comparison with existing national and international standards: a cross-sectional study. Journal of Child Science. 2021 Jan;11(01):e306-12.
11. Franco P, Putois B, Guyon A, Raoux A, Papadopoulou M, Guignard-Perret A, Bat-Pitault F, Hartley S, Plancoulaine S. Sleep during development: sex and gender differences. Sleep Medicine Reviews. 2020 Jun 1;51:101276.
12. Bardham AM. The effect of parity and maternal age on birth weight. Journal of the National Medical Association. 1966 May;58(3):194.
13. Feleke Y, Enquoselassie F. Maternal age, parity and gestational age on the size of the newborn in Addis Ababa. East African medical journal. 1999;76(8):468-71.
14. Teshome D, Telahun T, Solomon D, Abdulhamid I. A study on birth weight in a teaching-referral hospital, Gondar, Ethiopia. The Central African Journal of Medicine. 2006;52(1-2):8-11

15. Arima L, Kaori D. Risk factors for low birth weight infants in Japanese pregnancies: a one-year study of 2551 cases in Tokyo. International Journal of Pediatrics& Neonatal Care. 2017;2:122
16. The effects of maternal age and parity on the birth weight of newborns among mothers with singleton pregnancies and at term deliveries Alehegn Bekele1 , Girma Seyoum1, Kiflome Tesfaye, Yitbarek Fantahun 2019
17. Wang S, Yang L, Shang L, Yang W, Qi C, Huang L, Xie G, Wang R, Chung MC. Changing trends of birth weight with maternal age: a cross-sectional study in Xi'an city of Northwestern China. BMC Pregnancy and Childbirth. 2020 Dec;20(1):1-8

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Research on the Impact of Breathing Exercises and Aerobic Exercises on Quality of Life in Patients with Bronchial Asthma: A Comparative Study

Kartik Chhonker[1*], Kalpana Jain[2], Gunjan Shukla[3] Namrata Srivastava[4]

[1]Assistant Professor Career College Bhopal, [2]Associate Professor Career College Bhopal,
[3]Professor Career College Bhopal, [4] HOD, professor Career College Bhopal.

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ABSTRACT

Background: Asthma is defined as a chronic inflammatory disorder of airways characterized by reversible airflow obstruction causing cough, wheeze, chest tightness and shortness of breath Crompton et al7Asthmatic attacks are set up by exposure to specific allergens such as house dust mite, pollen and animal dander. Some other factors are exercise particularly running, dyes, air pollution, infection, cigarette smoke, dry inhaled air, certain foods such as fish, eggs, yeast, and wheat which presumably reach the bronchi via blood stream. There is noticeable increase in healthcare burden from asthma in several areas of world .The most frequently mentioned aims of breathing exercises are to 'normalize' breathing pattern by adopting a slower respiratory rate with longer expiration and reduction of hyperventilation and hyperinflation. Training also frequently involves encouraging nasal breathing and a diaphragmatic breathing pattern.AQLQ AND SF36 questionnaire was used as outcome measure.

Methods: The sample size of this study was 30 subjects with 15 subjects in each group. The group A was given breathing exercises interventions and group B was given aerobic exercises intervention. A written consent was taken from each before their participation into the study. Asthma Quality of Life Questionnaire (AQLQ) and SF-36 quality of life Questionnaire of both the groups were taken in 0 week and both groups were assigned treatment interventions and after 3 weeks the AQLQ and SF-36 quality of life questionnaire has been repeated.

The independent variables in the study were Aerobic Exercises and Breathing Exercises.

Conclusion: The breathing exercise intervention was effective in improving the quality of life in asthmatic patients. The aerobic exercise intervention was also effective in improving the quality of life in asthmatic patients. However, the quantum of reduction in lung obstruction and therefore, the overall improvement in quality of life found to be more significant with the aerobic exercise intervention than breathing exercise intervention. Thus, a combination of the breathing exercises and aerobic exercise should be incorporated into the pulmonary rehabilitation program of the asthmatic patients.

Keywords: Asthma, Breathing exercises, Aerobic exercises, AQLQ & SF36 questionnaire.

Consent: informed consent was taken from all participants in the study for the publication work in the journal.

INTRODUCTION

Asthma is defined as a chronic inflammatory disorder of airways characterized by reversible airflow obstruction causing cough, wheeze, chest tightness and shortness of breath Crompton et al [(7).] Asthmatic attacks are set up

Corresponding author: Kartik Chhonker, Assistant Professor Career College Bhopal

Email: kartikchetan@gmail.com

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by exposure to specific allergens such as house dust mite, pollen and animal dander. Some other factors are exercise particularly running, dyes, air pollution, infection, cigarette smoke, dry inhaled air, certain foods such as fish, eggs, yeast, and wheat which presumably reach the bronchi via blood stream. There is noticeable increase in healthcare burden from asthma in several areas of world. Over 50 million people in Central and Southern Asia have asthma and many do not have access to the medications that control the disease. Significant changes were observed in FEV1, FVC, PEF, PEF25-75%, MVV, RF and 6MWT between asthmatic patients of the two groups (P≤0.05), but FEV1/FVC showed no significant changes.

Many studies have been conducted related to prevalence of asthma; few studies have tried to examine the efficacy of breathing exercise and aerobic exercise in a single study. Therefore, the present study was conducted to compare the role of breathing exercise with that of aerobic exercise in the patients of asthma. The study has also explored physiological capacities of lung in these patients.Asthma is the most common chronic illness of childhood, affecting approximately 10% of children[1]. In the United States alone, approximately 2.2 million ambulatory care visits per year are made by children for the treatment of asthma[2]. Asthma is an inflammatory disorder with airway hyper responsiveness leading to recurrent episodes of wheezing, breathlessness, chest tightness and coughing, especially during the night and the early morning[1,2].

The most frequently mentioned aims of breathing exercises are to 'normalize' breathing pattern by adopting a slower respiratory rate with longer expiration and reduction of hyperventilation and hyperinflation. Training also frequently involves encouraging nasal breathing and a diaphragmatic breathing pattern. This is based on the assumption that patients with asthma have abnormal or dysfunctional breathing patterns[7].

Although aerobic exercise can provoke Exercise-Induced Bronchoconstriction (EIB) in patients with asthma, regular physical activity and participation in sports are considered to be important components in the overall management of asthma.

A recent international guideline regarding physiotherapeutic management of adult patients recommends breathing exercises for patients with asthma to increase asthma control and quality of life (evidence grade A).Physical training is advised to increase fitness and cardio-respiratory endurance, to decrease dyspnoea and improve quality of life (evidence grade B).

METHODOLOGY

The sample size of this study was 30 subjects with 15 subjects in each group. The group A was given breathing exercises interventions and group B was given aerobic exercises intervention.

These thirty subjects suffering with asthma were recruited for the study. A written consent was taken from each before their participation into the study. Asthma Quality of Life Questionnaire(AQLQ)and SF-36 quality of life Questionnaire of both the groups were taken in 0 week and both groups were assigned treatment interventions and after 3 weeks the AQLQ and SF-36 quality of life questionnaire was repeated. The independent variables in the study were Aerobic Exercises and Breathing Exercises.

The dependent variable in the study were AQLQ and SF-36 quality of life Questionnaire score. Dependent variable was measured initially at baseline and then at three weeks for both groups.

Breathing exercises intervention include Diaphragmatic breathing exercise practised for 15 minutes. This exercise was performed in Semi-Fowler's position with the patient totally relaxed. Ask patient to place his/her hands on abdomen, on rectus abdominis just below anterior costal margin. Ask the patient to breath slowly and deeply through the nose.The patient shouldkeep the shoulders relaxed and upper chest quiet allowing the abdomen to rise slightly. Then tell the patient to relax and exhale through the mouth. Do not allow the patient to hyperventilate.

Pursed –lip breathing exercise intervention should be practised after diaphragmatic breathing exercise intervention for another 15 minutes.

Patient is allowed to have rest in between the two interventions, not more than two minutes. This process involves pursing both the lips together while controlled exhalation. Now exhale through pursed lips and count till four.

Aerobic exercise intervention includes

1) **Warm up Phase-**to raise heart rate and temperature of muscles to provide adequate blood flow .This phase included general range of motion and flexibility exercises like arm circles, toe raises, half knee bend and running in place.
2) **Activity Phase-**included the rhythmic steps of aerobics with graceful dance movements with less jumping action, but more of footwork, which were coordinated with the rhythm of the music being played.
3) **Cool down Phase-**to gradually bring down the heart rate and metabolism to near normal.
4) **Duration Of Exercise**– 5-7 mins of warm-up 20 mins of activity. 5-7 mins of cool down period.
5) **Frequency Of Exercise**- 5 times a week for 3 weeks.

DATA ANALYSIS

Table 1: **Mean and Standard Deviation Values of Pre And Post Scores of Asthma Quality of Life Questionnairefor Group Of Patients Receiving Breathing Exercises**.

Subjects	Mean	Standard Deviation	Change in Value
PRE	30.2	18.6	18%
POST	36.7	18.1	

Table-2: Mean And Standard Deviation Values of Pre and Post Scores of Asthma Quality of Life Questionnaire for Group of Patients Receiving Aerobic Exercises

Subjects	Mean	Standard Deviation	Change in Value
PRE	31.2	17.5	23 %
POST	39.6	17.4	

Table 3: Mean Values For Pre And Post Sf-36 Questionnaire For Patients Recieving Breathing Exercise

Sf-36 Questionnaire	Mean Values	Sd Values	% Change
NORMAL	41.6	23.5	22%
POST (03 WEEKS)	51.4	24.6	

The mean of SF-36 questionnaire before and after 3 weeks shows 22 % values significant increase in quality of life following the treatment session.

Table 4: Mean Values For Pre And Post Sf-36 Questionnaire For Patients Recieving Breathing Exercises

Sf-36 Questionnaire	Mean Values	Sd Values	% Change
NORMAL	41.6	21.4	25&
POST (10 WEEKS)	55.4	22.1	

The mean of SF-36 questionnaire before and after 3 weeks shows 25 % values significant increase in quality of life following the treatment session .

DISCUSSION

Effect of breathing exercise intervention on Quality of Life of asthmatic patients

While analysing the effects of breathing exercise intervention on quality of life, it was found that overall improvement is % on the scale of Asthma quality of life questionnaire and % improvement in SF-36. Thus, breathing exercises have helped in improving all the of the asthmatic patients. Breathing exercises helped the patients to get back to their normal way of breathing process. It produced relaxation of accessory muscles.

Effects of aerobic exercise intervention on Quality of Life of asthmatic patients

The results of present investigation also exhibited % increase in the Asthma quality of life questionnaire and 24% increase in SF-36 values. The present finding that aerobic exercise improvised the activity in daily life of patients with bronchial asthma.

Ortancil O.et al.conducted a study on Twenty-two asthma patients. Breathing exercises and upper extremity exercises were taught to all the patients. The patients were then asked to practice these exercises at home individually for 6 weeks[9].

Kelly and Johnson conducted a study on the effects of aerobic exercise on resting systolic and diastolic blood pressure among asthmatic adults. The results of this study suggest that aerobic

exercise resulted in small reductions on resting systolic and diastolic blood pressure among asthmaticadults.[1]

Statistical analysis suggested that there was no significant difference in the level of improvement of quality of life. It is the well-known fact that in the normal breathing pattern the diaphragm moves downward when the person inhales and moves upward when the person exhales. However, an asthmatic patient breathes in an abnormal way by using only the upper portion of the chest for breathing. Over the period of time the patient develops weakness of chest muscles as the muscles are not being used properly. The findings of the present study have demonstrated that for the asthma patients breathing exercises can really help in reducing the airways obstruction. In addition to this, the breathing exercises help the person to use the inspiratory muscles. This mechanism may have helped in overcoming the feeling of the suffocation and breathlessness in the patients. During aerobic exercise, minute ventilation increases and an increased load is placed on the respiratory muscles. Both the frequency and the speed of contraction in the muscle are increased.

There were certain limitations during the study. As the study was basically for quality of life measurement spirometer and measurements of lung volumes was not used which would have solidify the results obtained further.

This study implies that breathing exercises and aerobic exercises not only helps improve respiratory function of patients with bronchial asthma but also helps in improving their quality of life.

CONCLUSION

In the present study it was concluded that- The breathing exercise intervention was effective in improving the quality of life in asthmatic patients. The aerobic exercise intervention was also effective in improving the quality of life in asthmatic patients. However, the quantum of reduction in lung obstruction and therefore, the overall improvement in quality of life found to be more significant with the aerobic exercise intervention than breathing exercise intervention. Thus, a combination of the breathing exercises and aerobic exercise should be incorporated into the pulmonary rehabilitation program of the asthmatic patients.

Ethical Clearance: This study was approved by our institutional ethical committee.

Source of funding : self

Conflict of interest : nil

REFERENCES

1. Haas, F., Pasierski, S., Levine, N., Bishop, M., Axen, K., Pineda, H. and Haas, AEffect of aerobic training on forced expiratory airflow in exercising asthmatic patients. J. Appl. Physiol. 63(3): 1230-1235: 1987
2. Hallstrand, T.S., Peter, M.D. ,Bates, F.C.C.P. and Schoene, R.B. Aerobic Conditioning in Mild Asthma Decreases the Hyperpnea of Exercise and Improves Exercise and Ventilatory Capacity. Chest 118: 1460-1469 :2000..
3. Jia CE, Zhang HP, Lv Y, Liang R, Jiang YQ, Powell H, Fu JJ, Wang L, Gibson PG, Wang G: The Asthma Control Test and Asthma Control Questionnaire for assessing asthma control: systematic review and meta-analysis. J Allergy Clin Immunol. 2013, 131 (3): 695-703. 10.1016/j.jaci.2012.08.023.
4. Fanelli A, Cabral AL, Neder JA, Martins MA, Carvalho CR: Exercise training on disease control and quality of life in asthmatic children. Med Sci Sports Exerc. 2007, 39 (9): 1474-1480.
5. Nagarathna R, Nagendra HR: Yoga for bronchial asthma: a controlled study. Br Med J (Clin Res Ed). 1985, 291 (6502): 1077-1079. 10.1136/bmj.291.6502.1077.
6. Hou YS, Li J, Hou L. The effect of rehabilitation exercise prescription on breathing function of teenage bronchial asthma sufferers. J Phys Educ. 2006;13:58–60.
7. Menzies-Gow A, Bafadhel M, Busse WW, et al. An expert consensus framework for asthma remission as a treatment goal. J Allergy Clin Immunol. 2020;145(3):757–765.
8. Wu CR. Effects of lip contraction and abdominal breathing combined with breathing exercises on lung function and quality of life in patients with asthma. J Clin Res. 2016;33:2025–2027.
9. Raghavendra P, Shetty P, Shetty S, et al. Effect of high-frequency yoga breathing on pulmonary functions in patients with asthma: a randomized clinical trial. Ann Allergy Asthma Immunol. 2016;117(5):550–551.
10. Gershon AS, Guan J, Wang C, To T. Trends in asthma prevalence and incidence in Ontario, Canada, 1996–2005: a population study. *Am J Epidemiol.* 2010;**172**(6):728–736.
11. Rauscher, M.. Aerobic fitness improves asthma control in kids. Med. Sci. Sport. Exer. 39(9): 1474–1480. 2007
12. Saxena, T., Saxena, M.. The effect of various breathing exercises (pranayama) in patients with bronchial asthma of mild to moderate severity. Int. J. Yoga (2): 22-25.2009

13. Aggarwal, A.N., Chaudhary, K., Chhabra, S.K., D"Souza, G.A., Gupta, D., Jindal, S.K., Katiyar, S.K., Kumar, R., Shah, B. and Vijayan, V.K.. In Prevalence of risk factors for bronchial asthma in Indian adults: A multicentre study. Indian J. Chest. Dis. Allied Sci. 48: 13-22.2006.
14. Awasthy, S., Kalra, E., Roy, S., and Awasthy, S. 2004. Prevalence of risk factors of asthma and wheeze in school-going children in lucknow, North India. Indian Pediatrics.. Chatkin, M.N., Menezes, A.M.B., Macedo, S.E.C. and Fiss E.. Asthma and lung functions in a birth cohort at 6-7years of age in Southern Brazil 41: 1205-12102008.
.15. Stein RT, Martinez FD. Asthma phenotypes in childhood: lessons from an epidemiological approach. Paediatr Respir Rev. 2004;5(2):155–161

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Occupational Therapy and Assistive Technology: Experience in Using 3D Printing and Open Source Platforms

Luciana Ramos Baleotti[1], Amanda Letícia Santos da Silva[2], Roberta Martinelli Palacio[3]*

São Paulo State University (Unesp) School of Philosophy and Sciences, Marília Campus, São Paulo, Brazil.

[1]Professor of the Postgraduate Program in Human Development and Technologies, Institute of Biosciences, UNESP, Rio Claro Campus. Level II PhD Professor of the Occupational Therapy course, Department of Physiotherapy and Occupational Therapy, School of Philosophy and Sciences, Unesp, Marília Campus, São Paulo, Brazil, [2]Occupational Therapist, Master's student in the Postgraduate Program in Human Development and Technologies, São Paulo State University - Institute of Biosciences, Unesp, Rio Claro Campus, São Paulo, Brazil., [3]Graduate in Occupational Therapy in São Paulo State University, UNESP, Marília Campus, São Paulo, Brazil

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ABSTRACT

Three-dimensional printing technology has evolved rapidly, being widely spread throughout the world and used in various fields such as design, engineering, medicine, and dentistry, among others. However, it is still little used in research and clinical practice in occupational therapy. A report is presented on the use of three-dimensional printing and open source platforms in clinical practice, based on experience in research and extension activity developed by the Laboratory for Research in Neuropediatrics, Technology and Inclusion (LINTI), which aims to provide an assistive product made in 3D printing to patients treated in the Supervised Internship in Occupational Therapy services that take place at the Specialized Rehabilitation Center (CER II). The actions are developed in four stages: 1- identification of the need; 2 - problem analysis and specification of the open source product; 3 – 3D printing production; 4- user assistive product validation tests. This project has highlighted the possibility of creating functional, accessible assistive products, with desired aesthetics, and above all, with modification alternatives and adjustments for the user. 3D printing technology and open source platforms can be applicable and innovative tools in the practice of occupational therapists working in assistive technology.

Keywords: Occupational Therapy; Printing Three-Dimensional; Self-Help Devices.

INTRODUCTION

Assistive Technology (AT) is an area that encompasses interdisciplinary knowledge related to products, strategies, methodologies, and services that seek to promote functionality, autonomy, social participation, and quality of life of people with disabilities, whether permanent or temporary, mobility-reduced, or other health conditions that impact functionality[1]. When it comes to promoting functionality and eliminating barriers, AT represents an indispensable element in allowing people with disabilities to live more independent, healthy, productive, and dignified lives[2,3].

Considering the perspective of interdisciplinarity that permeates AT, professionals

Corresponding author: Roberta Martinelli Palacio, Graduate in Occupational Therapy in São Paulo State University, UNESP, Marília Campus, São Paulo, Brazil

Email:roberta.palacio@unesp.br

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from different areas dialogue, enabling the sharing of ideas and the personalization of the assistive product according to the needs of each user[4]. One of the professionals involved with AT is the occupational therapist, who uses the understanding of the transactional relationship between the user's bodily functions and structures, their involvement in occupations considered important, and the context in which they are inserted, with this they can plan interventions that facilitate or increase participation and occupational performance[5] and, in many cases, AT is essential.

Thinking exclusively about offering assistive products, in recent years 3D printing technology has proven to be a promising alternative for manufacturing these products. The main advantage of 3D printing is the ease of producing individual, personalized, and low-cost resources[6]. This technology provides different possibilities, such as refining adaptations on an individual basis, avoiding the use of materials that may cause discomfort to the user, improving the aesthetics of the product, and lowering costs compared to other AT products available on the market[7]. Such factors allow the user to respond positively to emotional demands, increasing treatment adherence and, consequently, reducing the possibility of abandoning AT[8].

3D printing technology has gained space in the practice of occupational therapists (OT) who have services in the area of AT and, as a result, has fostered multidisciplinarity between OTs, designers, and engineers in the search for innovative alternatives in this area[4,9-11]. The clinical knowledge of the OT regarding the user's needs has proven to be an important ally for the designer concerning the development of assistive products in 3D printing[12].

From the point of view of OTs, the use of 3D printing for the development of orthoses can be more precise, with lower cost and better aesthetics, however, this technology is not part of the curriculum of most OT training courses[13]. In the field of OT, knowledge about 3D printing is still incipient, mainly because it demands high and specific levels of knowledge[14,15] such as those related to modeling software, and printing parameters, among others, which makes multidisciplinary even more relevant and essential in this area and highlights the need for initial and continued training for OT who intend to use 3D printing in the area of AT.

Because they do not know how 3D printing works, its potential in clinical practice, and its viability, many OTs end up not using this technology. However, there is the possibility of purchasing 3D printing assistive products that are available for free on Open Source websites such as Thingiverse (https://www.thingiverse.com), which help to mitigate the knowledge barrier caused by the proliferation of friendlier, less specialized software user interfaces16, and require little to no costomization17.

Open source is a concept that describes products or ideas in which "the intellectual contribution of the inventors is not proprietary in nature"[18]. The successful results and democratization of open source software inspired the creation of Open Source Hardware (OSH)[19], tangible, electrical, or mechanical products that anyone can use, allowing changes, distribution, and use[20]. Open Source Hardware distribution platforms are relevant as they have accessible materials and free model repositories, and allow more people to benefit from these services.

Such platforms can enable OT to materialize low-cost assistive products, in addition, they have two main purposes: to act as a community platform and to provide tools that allow satisfactory contributions, as well as the exchange of information and knowledge between users[21]. Open-source files have standardized devices that can be downloaded and printed according to parameters indicated for each piece, many of the files allow size adjustments[22], an extremely relevant feature, as it allows the product to be adjusted to the user to make it functional and custom.

At OT, studies on the use of 3D printing technology and files available on open-source websites for the implementation of assistive devices are still incipient. These technologies innovate how OTs have been developing assistive technologies for decades and can be implemented by OTs with knowledge in AT and 3D printing.[23]

It is in this direction that the proposition of this report is configured, which aims to contribute to reflections on the possibility of using Open Source platforms and 3D printing to make AT products available in Occupational Therapy services.

The Proposal

The experience of a research and extension project developed by the Laboratório de Investigação em Neuropediatria, Tecnologia e Inclusão (LINTI) is presented, whose actions seek to meet the need to make an assistive product made using 3D printing available to patients treated in Supervised Internship services in OT which take place at the Centro Especializado de Reabilitação (CER II) -Specialized Rehabilitation Center, linked to the São Paulo State University (UNESP), Marília campus. At CER II, patients with different health conditions are cared for, from childhood to the elderly, in the areas of Physiotherapy, Speech Therapy, and Occupational Therapy. Concerning OT, supervised internship practices are carried out in Neuropediatrics; Adult Neurology; Orthopedics; Social Programs – Child care, and Geriatrics. It is noted that this project began in May 2022 and includes collaborative actions with teachers/internship supervisors in OT, and with fourth-year OT students who carry out internships at CER II.

To constitute a collaborative proposal, the project is developed in four stages: identification of need, product specification, production, and validation. The four stages were established based on Löbach[24] (2001) and Baxter[25] (2003), which are described below.

Step 1- Identification of the need

Firstly, contact is maintained with supervisors and interns to identify whether they determine the need for an assistive product to perform daily tasks based on the analysis of the results of the occupational therapeutic assessments carried out with the patient and/or caregivers. In this way, patients who will benefit from AT are identified and selected, who are previously informed by the OT interns and, accordingly, the student members of this project use the Brazilian version of the Canadian Occupational Performance Measure – COPM[26] with the patient and/or caregiver to document the level of importance of the occupational activity that is intended to be improved through the use of AT, obtained through a scale of 1 to 10 (1=not very important; 10=very important), scoring also perceived performance (1=unable to perform it; 10=able to perform it extremely well) and satisfaction with performance (1=not at all satisfied; 10=extremely satisfied). At this point, the user's preferred color for implementing the assistive product is also investigated by demonstrating the colors of the filaments available for 3D printing of the product. This is one of the aspects that contributes to greater user adherence to the product and reduces the possibility of abandonment[27].

Because we seek to meet greater user demand, after scoring performance and satisfaction, the user is asked to select only one activity that they consider can benefit from the use of an assistive device, and that is most meaningful and relevant to them. him in his daily life, making it clear that he can purchase other assistive devices in the future, if necessary and if he so desires. Additionally, this criterion allows for greater coordination between teaching, research, and university extension activities, to favor the educational process of a greater number of undergraduate students and not just students linked to the project.

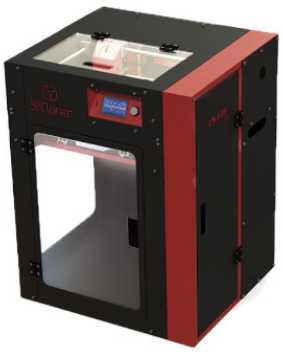
Step 2 - Problem Analysis and Open Source Product Specification

The second stage begins with a discussion among project members about the importance of the relationship that needs to exist between the demands of the subject and the task to be performed to define the specifications of the assistive product. Then, the search for it begins on the open-source platform Thingiverse (www.thingiverse.com), and at the Centro Tecnológico de Acessibilidade (CTA) of the Federal Institute of Rio Grande do Sul (www.cta.ifrs.edu.br). Several AT products available on the market are high-cost, produced on a large scale, and may not meet the user's exclusive demand28. Thus, the Open Source platform is an alternative that facilitates access and production of low-cost assistive products, with refined and personalized parts. To search for the desired product, keywords corresponding to it are used. However, it is important to highlight that

it is not always possible to find what is available through the use of keywords, as the AT sought is often not included in the category in which it is intended29. To illustrate, during the search for an assistive device to replace the shoelace, it was acquired using the keyword "awesome", a term suggested in the "tags" section of other resources found previously. This setback highlights the problem raised by Buehler et al.29 (2015), who emphasizes that the majority of designers who make files available on Open Source platforms do not have knowledge of AT, and by making them available without adding keywords consistent with the product's assistive function for users to find the solutions they are looking for.

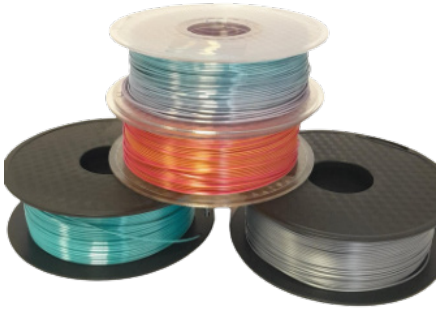
Step 3 – 3D printing production

Once the product is selected, the file is downloaded in "STL" format and, using the Matter Control 1.7 slicing software, converted into "OBJ". LINTI uses a 3D printer (Figure 1) with Fused Deposition Modeling (FDM) technology, which generates a 3D object by adding layers of filaments. The materials most used in this type of process are Acrylonitrile Butadiene Styrene (ABS) and Polylactic Acid (PLA). ABS is a petroleum-derived filament whose main characteristic is its flexibility, allowing for more detailed work on parts and the creation of objects that do not break easily. PLA (Figure 2) is a non-toxic and biodegradable thermoplastic, originating from natural renewable sources (corn starch, sugar cane, beet, and potato), available on the market in a variety of colors and brands. This material is easy to use due to its physical and chemical characteristics[30], and because it has low contraction and allows greater control of the final dimensions of the object, it is recommended for printing large and technical parts, which will suffer friction.



Source: LINTI Files

Figure1: FDM type 3D printer



Source: LINTI Files

Figure 2: PLA Filaments

Stage 4 – User assistive product validation tests

At this stage, the printed product is first analyzed by all project members to check the quality of the printing and, if necessary, the product is printed again. Subsequently, this is delivered to the OT intern to make it available to the beneficiary for usability tests, aiming to obtain their opinion regarding performance and satisfaction with the occupational activity to be carried out with the assistive product, as well as satisfaction regarding the characteristics of the product in terms of comfort, functionality, and aesthetics, and the service offered.

To this end, users are oriented and trained on how to use the device, and after fifteen consecutive days of use, project members reapply to the COPM, and apply the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0), validated for Brazil by Carvalho et. al.31(2014), which aims to evaluate user satisfaction with assistive technology in various aspects (dimensions, weight, ease of adjustment, stability, and safety, durability, ease of use, comfort and effectiveness), and with the service offered (delivery process, repairs, and technical assistance, quality of professional services and follow-up services) with scores ranging from 1 to 5 (1 – Dissatisfied to 5 – Completely Satisfied). The proposition is to investigate the adequacy of the assistive product to the user's demands so that, if dissatisfaction is found with the functionality

Table 1. Assistive solutions in 3D printing and beneficiaries

Assistive Product	Beneficiares
Thingiverse - Plastic bottle opener 	Child, male, three years old, was diagnosed with Obstetric Brachial Palsy. Demand: open a plastic bottle using both hands. 
CTA - Acionador de Bastão(stick trigger) 	Child, female, eight years old, diagnosed with Spastic Quadriplegic Cerebral Palsy. Demand: encourage active play. 
Thingiverse - Bag holder   Option 1 Option 2	Adult, female, 32 years old, diagnosed with Brachioradial Injury. Demand: transport bags and purses. 
Thingiverse - Cutlery Holder 	Child, female, 9 years old, diagnosed with Quadriplegic Cerebral Palsy. Demand: take the food to the mouth. 

Assistive Product	Beneficiares
Thingiverse - Klots: quick shoe ties 	Child, male, eight years old, was diagnosed with Diparetic Cerebral Palsy. Demand: tie your sneaker laces 

Source: Authors

Based on the above, it is believed that 3D printing technology and the use of open-source platforms represent an innovation in the practice of OT, as they enable not only the development of functional assistive technologies (ATs), but also those that address issues aesthetic and low-cost, which influence user satisfaction and contribute to the acceptance and usability of ATs. Although the literature regarding the use of 3D printing by OTs has evolved in recent years, it is still quite scarce, the presentation of this report adds information to this growing body of knowledge.

Conclusion

This report aimed to demonstrate the feasibility of 3D printing and open source platforms in occupational therapeutic practice and the procedures and protocols used for evaluation, prescription, selection of assistive products, and user monitoring. The actions were based on user-centered practice, prioritizing user participation throughout the process, allowing feedback and adjustment of the assistive product with quick and effective solutions. This report demonstrates the potential of 3D printing for the development of ATs, and points to the opportunity to innovate the practice of OT in AT.

Conflict of Interest

The authors Luciana Ramos Baleotti, Amanda Letícia Santos da Silvaand Roberta Martinelli Palacio of the manuscript entitled “Occupational Therapy and Assistive Technology: Experience in Using 3D Printing and Open Source Platforms” declare that there are no conflicts of interest of a personal, commercial, academic, political and/or financial nature, in the process of assessment and publication of the aforementioned article.

Source of Funding

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Ethical Clearance

I certify that I participated in the conception of the work to make public my responsibility for its content, as well as that I presented pertinent information about the sources of resources received for the development of the research.

I declare that there are no connections or agreements between the authors and funding sources that characterize a real, potential, or apparent conflict of interest that may have affected the results of this work.

I certify that when the research involved experiments with human beings there was appreciation and approval by the Ethics Committee of the relevant institution and that the dissemination of images was authorized, assuming full responsibility for the same.

I certify that the text is original and that the work, in part or in full, or any other material authored by me with substantially similar content, has not been sent to another journal, in printed or electronic format.

I certify that, if requested, I will provide or cooperate fully in obtaining and providing data

on which the text is based, for examination by the editors.

REFERENCES

1. Tecnologia Assistiva. Presidência da República Secretaria Especial dos Direitos Humanos Subsecretaria Nacional de Promoção dos Direitos da Pessoa com Deficiência Comitê de Ajudas Técnicas [Internet]. 2009. Available from: https://www.galvaofilho.net/livro-tecnologia-assistiva_CAT.pdf
2. World Health Organization. Assistive technology [Internet]. Who.int. World Health Organization: WHO; 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/assistive-technology
3. Word Health Organization. Global disability action plan 2014-2021: Better health for all people with disability [Internet]. Who.int. World Health Organization: WHO; 2023. Available from: https://apps.who.int/iris/bitstream/handle/10665/199544/9789241509619_eng.pdf;jsessioni%20d=24CECD060B96DC503BB9BD04ADE21A01?sequence=
4. Rodrigues A.C.T, Medola F.O, Baleotti L.R. O uso da Impressão 3D na Tecnologia Assistiva. In: Paschoarelli L.C., Menezes M.S. Design: tecnologia a serviço da qualidade de vida. Bauru: Canal 6; 2020. 30-45.
5. American Occupational Therapy Association. Occupational therapy practice framework: Domain and process. American Journal of Occupational Therapy. 2020 Aug 31;74(4).
6. Lee KH, Kim DK, Cha YH, Kwon JY, Kim DH, Kim SJ. Personalized assistive device manufactured by 3D modelling and printing techniques. Disability and Rehabilitation: Assistive Technology. 2018 Oct 14;14(5):526–31.
7. Rodrigues Júnior JL, Cruz LM de S, Sarmanho APS. Impressora 3D no desenvolvimento das pesquisas com próteses / 3D Printer in the development of researches with prosthesis. Revista Interinstitucional Brasileira de Terapia Ocupacional - REVISBRATO. 2018 Apr 30;2(2):398–413.
8. Ganesan B, Al-Jumaily A and Luximon A. 3D Printing Technology Applications in Occupational Therapy. Phys Med Rehabil Int. 2016; 3(3): 1085.
9. Janson R, Burkhart K, Firchau C, Hicks K, Pittman M, Yopps M, et al. Three-dimensional printed assistive devices for addressing occupational performance issues of the hand: A case report. Journal of Hand Therapy [Internet]. 2020 Apr 1;33(2):164–9. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0894113020300739
10. Baleotti L.R, Medola F.O, Rodrigues O.V. Digitalização e Impressão 3D na Tecnologia Assistiva: Desenvolvimento de Órtese de Membro Superior. In: Medola F.O., Paschoarelli L.C. Tecnologia Assistiva: Desenvolvimento e Aplicação. Bauru: Canal 6 Editora; 2018. 199-206.
11. Da Silva RS, Da Silva ARM, Calegari EP, Teixeira FG. Proposta interdisciplinar do design de produtos com a terapia ocupacional no processo de desenvolvimento de produtos para crianças com baixa visão. Design e Tecnologia. 2014 Jul 2;4(07):10.
12. Aflatoony L, Lee SJ, Sanford J. Collective making: Co-designing 3D printed assistive technologies with occupational therapists, designers, and end-users. Assistive Technology. 2021 Oct 18;1–10.
13. Portnoy S, Barmin N, Elimelech M, Assaly B, Oren S, Shanan R, et al. Automated 3D-printed finger orthosis versus manual orthosis preparation by occupational therapy students: Preparation time, product weight, and user satisfaction. Journal of Hand Therapy. 2020 Apr;33(2):174–9.
14. Buehler E, Kane SK, Hurst A. ABC and 3D. Proceedings of the 16th international ACM SIGACCESS conference on Computers & accessibility - ASSETS '14. 2014.
15. Buehler E, Comrie N, Hofmann M, McDonald S, Hurst A. Investigating the Implications of 3D Printing in Special Education. ACM Transactions on Accessible Computing. 2016 Mar 18;8(3):1–28.
16. Anderson C. Makers: the new industrial revolution. New York: Crown Business; 2014.
17. Patterson RM, Salatin B, Janson R, Salinas SP, Mullins MJS. A current snapshot of the state of 3D printing in hand rehabilitation. Journal of Hand Therapy. 2020 Apr;33(2):156–63.
18. Foresti T. Proposição de um protocolo de orientação para fabricação e avaliação de órteses de membros superiores impressas em 3D. Porto Alegre. Tese (Doutorado em Design) - Universidade Federal do Rio Grande do Sul; 2020.
19. Moraes J, Priscila, Rosário D, Ubiratan Holanda Bezerra, Cerqueira E, Emília M, et al. Implementação de um cluster Kubernetes com a plataforma Dojot para Aplicações de Internet das Coisas. 2021 Jul 18.
20. The TAPR Open Hardware License – TAPR [Internet]. tapr.org. [cited 2023 Sep 22]. Available from: https://tapr.org/the-tapr-open-hardware-license/
21. Hansen A, Howard TJ. The Current State of Open Source Hardware: The Need for an Open Source Development Platform. Lecture Notes in Mechanical Engineering. 2013;977–88.
22. Ferrari A.L, Medola F.O, Baleotti L.R. Design, Tecnologia Assistiva e Impressão 3D: Otimizando a relação entre usuários, órteses e próteses. In: Paschoarelli L.C., Menezes M.S. Design: Tecnologia a serviço da qualidade de vida. Bauru: Canal 6; 2020. 75-92.
23. Baleotti L., Cavalcanti A. Impressão 3D no Desenvolvimento de Produtos Assistivos. In: Cavalcanti A, Galvão C. Terapia Ocupacional: Fundamentação e Prática. Rio de Janeiro: Guanabara Koogan; 2023. 822-827.
24. Bernd Löbach, Freddy Van Camp. Design industrial : bases para a configuração dos produtos industriais. São Paulo": Edgard Blücher; 2001.
25. Baxter J, Chua WF. Alternative management accounting research—whence and whither. Accounting, Organizations and Society. 2003 Feb;28(2-3):97–126
26. Law M, Petrenchik T, King G, Hurley P. Perceived Environmental Barriers to Recreational, Community, and School Participation for Children and Youth With Physical

Disabilities. Archives of Physical Medicine and Rehabilitation. 2007 Dec;88(12):1636–42.

27. Siqueira SS, Bandini HHM. Fatores associados à adesão ao uso de órteses de membro superior sob diferentes perspectivas. Revista Eletrônica Acervo Saúde. 2021 Jan 31;13(1):e5690.
28. Volpato N. Manufatura Aditiva Tecnologias e Aplicações Da Impressão 3D. São Paulo: Editora Edgard Blucher Ltda.; 2021.
29. Buehler E, Branham S, Ali A, Chang JJ, Hofmann MK, Hurst A, et al. Sharing is Caring. Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15. 2015.
30. Wu G, Liu S, Jia H, Dai J. Preparation and properties of heat resistant polylactic acid (PLA)/Nano-SiO2 composite filament. Journal of Wuhan University of Technology-Mater Sci Ed. 2016 Feb;31(1):164–71.
31. Carvalho KEC de, Gois Júnior MB, Sá KN. Tradução e validação do Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) para o idioma português do Brasil. Revista Brasileira de Reumatologia. 2014 Jul;54(4):260–7.

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Effect of Immersive Virtual Reality Environment on Reaction Time, Agility and Coordination among Collegiate Students

Minal Goyal[1*] , Manharleen Kaur[2] , Loveleen[3] , Navneet Kaur[4]

[1]MPT (Sports), Physiotherapy Student, All Saints Institute of Medical Sciences and Research, Ludhiana, [2,3]Associate Professor, Physiotherapy department, All Saints Institute of Medical Sciences and Research, Ludhiana, [4]MPT (Neurology), Physiotherapy Student, All Saints Institute of Medical Sciences and Research, Ludhiana.

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ABSTRACT

Background: Virtual reality is the sum of the hardware and software systems that seek to perfect an all-inclusive, sensory illusion of being present in another environment which is applied to a broad range of sports such as skiing, goalkeeping rugby union, baseball and basketball, pistol shooting and cycling speed. Reaction time is the elapsed time between stimulus onset and an individual's response on elementary cognitive tasks. Coordination is the capability to perform a sequence of movements rhythmically smoothly and accurately. Agility refers to the capacity to quickly change the location of the entire body in space with quickness and accuracy

Objectives: The main objective of this study was to see the effect of virtual reality table tennis on coordination, reaction time and agility among collegiate students.

Material and Methods: Based on inclusion and exclusion criteria, 60 collegiate students of age group 18-24 years were taken. The subjects were divided into two groups as group A and group B of 30 each. Group A played table tennis game in real environment and group B played table tennis in virtual environment. Pre and post score were taken for coordination, reaction time and agility using hand eye coordination test, plate tapping test and Davies test respectively. The data was collected, compiled and analyzed.

Result:Descriptive statistics, paired & unpaired 't' test were used for the intra-group and intergroup comparison. Significant improvements were seen in post scores of coordination, reaction time and agilityin both groups at 0.05 level in both real and virtual table tennis groups. However, when both groups were compared, non-significant differences were observed in all the variables.

Conclusion:The study concluded that virtual reality table tennis is as effective as real table tennis in improving reaction time, coordination and agility among collegiate students.

Keywords: Virtual Reality, Table Tennis, Coordination, agility, Reaction Time.

INTRODUCTION

Developments in technology in the 21st century have increased by speeding the advancement of apps and software and making it easier to access all kinds of information but do have its demerits. Technology should not replace effective teaching but should be viewed as a supplement to appropriate pedagogical practices. One of the innovations of technology that began to appear in the past few years is'virtual Reality (VR)'. VR can immerse individuals in an atmosphere that would normally be inaccessible because of cost, danger, or restrictions.[1]

Corresponding author: Manharleen Kaur, Designation: Associate Professor, All Saints Institute of Medical Sciences and Research, Ludhiana, Punjab (141001)

Email: manharleensohal@gmail.com;

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In virtual reality (VR), computer images are utilized to simulate a realistic environment that responds to users.This environment is widely used in various industries due to its adaptability, dependability and variety.Thus, VE integrates reality with imagination and creates an environment that is akin to the one in which we move and live.[4]

This article focuses to see the effect of virtual reality gaming on the general physical fitness and performance coordination, reaction time and agility. Coordination is the capability to perform a sequence of movements rhythmically smoothly and accurately. It involves the sense of body, muscular contraction and joint movement of the body.[5] Agility refers to capacity to quickly change the location of the entire body in space with quickness and accuracy.[6] Reaction time refers to the time elapsed between stimulation and the beginning of the response to it.[6]

Any technique for improving or promoting physical activity is worthwhile researching in a society that is overweight and where obesity and inactivity are the fifth major causes of worldwide health.[7] The newest statistics show that Asia has more gamers than any other region (1.48 billion), thus it is crucial to investigate this topic to make it useful. Hayes and Silberman in 2007 discussed that video games are an underutilised tool for increasing young people's excitement and capacity to participate in sports and other movement-based activities.[8]However, their proposed model did not account for the need for physical movement when playing these games, which is provided by virtual reality-based gaming, that provides the full experience and refutes the notion that playing video games encourages a sedentary lifestyle.VR has been applied to a broad range of sports such as skiing, goalkeeping, baseball, basketball, pistol shooting and cycling. It can be considered an excellent tool to improve the quality and speed of learning and developing skills.[3]

It has a satisfactory effect on various aspects of sports rehabilitation such as attention deficits, spatial perception disorders, memory disorders in cognitive rehabilitation, anxiety, depression, phobia in emotional disorders, akinesia, chorea in mental diseases etc.[9]But this article focuses on the effect of virtual reality table tennis game on physical variables of fitness using table tennis game which is one of the most popular sport in the world, that requires complex spatial movements of the body like acceleration, deceleration, direction change, moving quickly and balance all helping players generate optimum stroke production.[10]

MATERIAL AND METHODS

Study Design: The study was an experimental study, which was comparative in nature.

Research settings: In and around Ludhiana

Sample Size: 60 subjects

Sampling technique: The sample of the study was selected by purposive sampling.

Study period: The study was completed in 10 months from June 2022 to April 2023.

Eligibility

Inclusion Criteria

- Subjects between age group of 18-25 years
- Both males and females were taken
- Subjects who were not involved in any routine sports training and conditioning program
- Recreational table tennis players who were familiar with the game for atleast 1 year
- Subjects with BMI ≤ 25

Exclusion Criteria

- Subjects with any soft tissue injury order formity
- Subjects with severe musculoskeletal, neural, somatic,and psychiatric conditions.
- Subjects involved in any recent strengthening programme.
- Non cooperative subjects.

Procedure

Based on inclusion and exclusion criteria, subjects with at least 1 year of table tennis experience who were not undergoing any strength training programme or suffering from any injury were taken. After that their height

and weight were measured to calculate their BMI using the formula, weight in kilograms divided by height in metres squared. 60 subjects with normal BMI were selected by purposive sampling and informed consent was taken. Subjects were divided into 2 groups with 30 subjects in each group. Group A and B played table tennis in real and virtual environment respectively.

Pre score for reaction time, coordination and agility through plate tapping test,hand eye coordination test and Davies test respectively were collected for all the participants. The participants were given time for familiarization.

Pre score for reaction time, coordination and agility through plate tapping test,hand eye coordination test and Davies test respectively were collected for all the participants. The participants were given time for familiarization.

1. Hand eye coordination test

This test was used to measure the co-ordination between eye and hand. One line was marked two meter away from the wall. Subjects start the test from starting line. On the signal of start, subject threw the ball against the wall and caught the ball with the other hand, after he caught it, he threw the ball with that hand and caught it with the other hand. This process continued for the 30 second. After 30 seconds, the timer gave the signal to stop and the numbers of correctly made catches were recorded.[5]

2. Plate tapping test

It was used to calculate the reaction time of an individual. The subject tried to touch 2 disks with the preferred hand in defined order in a fast way. Two 20-cm disks were placed on a table. The distance between the two disks to each other was 80cm (the edges are 60-cm to each other). 10 x 20cm rectangular plate was placed to an equally far area to both disks. The best score was considered as the final point. The point was the time used to touch each disk 25 times.[11]

2. Daviestest

The Davies test (DT) was used to assess upper body agility and stabilization.

Two pieces of tape were placed 36 inches apart on the ground. The participant started the test in a push-up position with one hand on each piece of tape. The participants were then asked to quickly touch their right hand with the left hand and continue to perform alternating touches on each side for 15 seconds. The number of touches by both hands were recorded.[12]

Group A included 30 subjects who played table tennis in real environment. The table tennis setup included a regular size table tennis table, two table tennis bats and 40mm table tennis balls. Two subjects were made to play at once with all the rules and regulations followed as set by the International Table Tennis Federation.The subjects were made aware of the techniques and rules at the beginning and all the subjects played under proper supervision as shown in figure 1. Protocol was given for 3 sessions in a week for 4 weeks.

Group B included 30 subjects who play Table tennis through VR. They were made to play “Ping-Pongpro”game on Sony Play Station 4. This game required the users to inter act by moving and responding to incoming stimuli. Subjects are armed with a singular paddle and face opponents. The Game started with a brief tutorial explaining all the mechanics and allows to adjust a multitude of settings to your liking from the height of the table, angle of the paddle and its position in player’s hand.The subject had to choose from 5 different stages and play against the computer with a wide range of difficulty settings allowing him to face the easiest of foes to some next level opponents in some very lively surroundings like a rather larger arcade, a busy neighbourhood, park, gymnasium and 1 or 2 more with each looking busy and alive.

They played on a PSVR setup that included Play Station 4 console, VR headset, Play Station camera, dual shock 4 wireless controllers, two Play Station move motion controllers, screen, ear phones. Subjects wore the headset and used one move motion controller in the dominant hand as table tennis racquet and other one was used to control the table tennis ball in the game, held in other hand. The subject’s movement of head and motion controller was captured and

Fig.1: Subjects playing table tennis in real environment

Fig. 3: Subject playing Ping pong pro game on PSVR

interpreted through the PS4 camera. The game was played against the AI opponent, according to the official table tennis rules. The difficulty of the AI ranged across five levels which differed with increase in speed of serve and returns, spins on ball from AI etc. After each game of 3 sets of 11 points, another

Fig. 2: VR Play Station 4 Setup

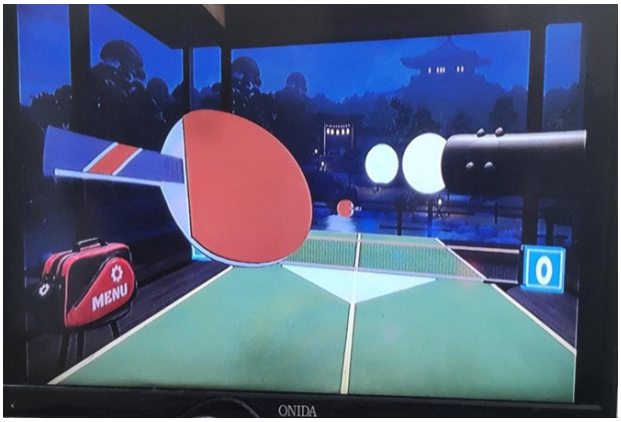

Fig. 4: VR Play Station 4 Setup

commenced. Subjects were given a familiarization session at the beginning to make them understand the task and to get them adapted to the virtual environment. Each session was given under full supervision as shown in figure 2. Protocol was given for 3 sessions per week for 4 weeks.

After 4 weeks of intervention, the post scores for reaction time, coordination and agility were collected for all the participants of group A and B. The pre and post scores for all the variables were the compiled and analyzed.

Statistical Analysis

The data was analyzed using descriptive statistics, paired 't' test and unpaired 't' test. Paired 't' test was used for intra group analysis and unpaired 't' test for inter group analysis.

RESULT

TABLE 1: Paired 't' test results for intragroup comparison for both group A and B

INTRAGROUP COMPARISON		Group A		Group B	
		PRE	POST	PRE	POST
HAND EYE COORDINATION	Mean	15.40	18.30	17.73	21.13
	SD	5.373	5.194	6.502	6.882
	t- value	5.83		6.18	
	p- value	<0.001*		<0.001*	
	Significance	Significant		Significant	
REACTION TIME	Mean	13.75	10.01	13.36	10.00
	SD	3.151	2.885	2.965	2.309
	t- value	5.22		6.08	
	p- value	<0.001*		<0.001*	
	Significance	Significant		Significant	
AGILITY	Mean	19.3	22.57	19.27	21.93
	SD	3.399	3.579	5.105	5.115
	t- value	4.841		4.929	
	p- value	<0.05*		<0.05*	
	Significance	Significant		Significant	

LOS= 0.05, df =29, 't' tab= 2.05
*p ≤ 0.05- significant
Paired 't' test gave 't' values that were statistically significant for coordination, reaction time and agility.

TABLE 2: Unpaired 't' test results for intergroup comparison between group A and B

INTERGROUP COMPARISON **Group A**		**PRE SCORES**		**POST SCORES**	
		Group B	**Group A**	**Group B**	
HAND EYE COORDINATION	Mean	15.40	17.73	18.30	21.13
	SD	5.37	6.50	5.19	6.88
	t- value	1.515		1.80	
	p- value	>0.05		>0.05	
	Significance	Non-significant		Non-significant	
REACTION TIME	Mean	13.75	13.36	10.01	10.00
	SD	3.151	2.965	2.88	2.30
	t- value	0.502		0.024	
	p- value	>0.05		>0.05	
	Significance	Non-significant		Non-significant	
AGILITY	Mean	19.03	19.27	22.57	21.93
	SD	3.9	5.10	3.579	5.112
	t- value	0.208		0.556	
	p- value	>0.05		>0.05	
	Significance	Non-significant		Non-significant	

LOS= 0.05, df =28, 't' tab= 2.00
*p less that 0.05- significant
Unpaired 't' test gave 't' values that were statistically non-significant for coordination, reaction time and agility both before and after the intervention.

DISCUSSION

The current study aimed to see the effect of virtual table tennis on coordination, reaction time, and balance of collegiate students and compare it with the effect of real table tennis. The subjects in this study had similar baseline values for age, height, weight and BMI. Data was meaningfully assorted through paired t test within the groups. Group A were who played table tennis in real world and group B were who played table tennis virtually. The results of the current study showed that the t values of hand eye coordination, reaction time and agility assessed using hand eye coordination test, plate tapping test and Davies test respectively, were statistically significant with $p<0.05$ in both group A and group B. Similar results were seen by Oagaz et al who conducted a study to see whether table tennis training through VR helps in performance improvement and skill transfer and concluded that complex skills can be learned in VR and that obtained skills can be transfered to the real world.[13]

After this, the scores of both group A and group B were compared using unpaired t test, the results showed that the t values were not statistically significant with $p>0.05$ for hand eye coordination, reaction time and dynamic balance. Though, the results showed significant improvement in scores after playing table tennis for 4 week in both virtual and real environment,but there is no significant difference in the effect of table tennis when played on real table tennis table or through virtual reality ping pong pro game on PSVR.

That is in line with a previous study conducted by Petri K et al. who compare the response quality and attack recognition in karate kumite between reality and virtual reality, and concluded that application of VR for training is appropriate and as effective as reality. Loba to DF also in his study compared the effects of plyometric and virtual training on physical and functional performance and concluded that both trainings are equally effective and appropriate.[15]

In line to the above results and discussion, this study concluded that virtual reality sports gaming is useful in improving coordination, reaction time and agility is equally effective as sports played in real environment.

CONCLUSION

The study concluded that there were no significant differences in effect of real and virtual environment gaming on reaction time, coordination and agility, therefore null hypothesis was accepted and alternate hypothesis was rejected at a 0.05 level of significance. The study found that people who played table tennis both in a real environment and through PSVR had a major improvement in reaction time, significant gains in coordination and a considerable increase in agility. The findings revealed that virtual reality table tennis is an equally effective, if not superior medium, for improving reaction time, coordination and agility among amateur collegiate students than real table tennis. The study found that virtual reality gaming can be utilized as a supplement or substitute to increase reaction time, coordination and agility in recreational players depending on the need.

Source of funding: No funding was obtained for the study

Conflict of Interest: No conflict of interest are present.

Ethical clearance: The research was conducted after ethical approval from Baba Farid Unniversity of Health Sciences. Written informed consent were provided by all participants prior to participation.

Study period: The study took 10 months for completion from June 2022 to April 2023.

Disclosure of relationships and activities:

Minal Goyal (author)- Reseach student of MPT(sports). The study was conducted by the author as dissertation work for MPT degree.

Manharleen Kaur(corresponding author)- Supervisor. The corresponding author was the guide under whose supervision the study was conducted. The research was thoroughly checked and assisted for proper procedure and ethical conduct at every step by the supervisor.

Loveleen (co-author)- Co-Supervisor. Co-guide for the research, assisted in permissions from different places for data

collection, proper procedure to conduct pre and post tests was taught and supervised, helped in compilation and analysis.

Navneet Kaur(co-author)- Fellow student, helped in collection and compilation of data. Helped in teaching the controls and rules of the game and supervised the participants during intervention.

REFERENCES

1. Zamzami M. The effectiveness of using virtual reality technology on learning the jump-shot skill in basketball. Journal MensSana. 2020 Dec 6;5(2):191-201.
2. Nalbant G, Bostan B. Interaction in virtual reality. In4th international symposium of interactive media design (ISIMD) 2006 Apr.
3. Covaci A, Postelnicu CC, Panfir AN, Talaba D. A virtual reality simulator for basketball free-throw skills development. In Doctoral Conference on Computing, Electrical and Industrial Systems 2012 Feb 27;105-112.
4. Fox J, Arena D, Bailenson JN. Virtual reality: A survival guide for the social scientist. Journal of Media Psychology. 2009 Jan; 21(3):95-113. .
5. Kalra S, Yadav J, Pawaria S. Effect of Pilates on Lower Limb Strength, Dynamic Balance, Agility and Coordination Skills in Aspiring State Level Badminton Players. Journal of Clinical & Diagnostic Research. 2019 Jul 1;13(7)
6. Abdullah MR, Hairi MS, Musa RM, Maliki AB, Kosni NA, Rasid SM, Adnan A, Azmee SH. Assessment of Basic Fitness Related Performance Components between Three Essential Co-Curriculum Units of University Sultan Zainal Abidin Malaysia. International Journal of Academic Research in Business and Social Sciences. 2017; 7:833-47.
7. Trout J, Christie B. Interactive video games in physical education. Journal of Physical Education, Recreation & Dance. 2007 May 1;78(5):29-45
8. Hayes E, Silberman L. Incorporating video games into physical education. Journal of Physical Education, Recreation & Dance. 2007 Mar 1; 78(3):18-24.
9. Rizzo AA, Schultheis M, Kerns KA, et al. Analysis of assets for virtual reality applications in neuropsychology. Neuropsychology Rehabilitation 2004:14:207-309
10. Gu Y, Yu C, Shao S, Baker JS. Effects of table tennis multiball training on dynamic posture control. PeerJ. 2019 Jan 16;6.
11. Berisha M, Cilli M. Comparison of eurofit test results of 11-17-year-old male and female Students in Kosovo. European Scientific Journal, ESJ. 2017;13(31):138.
12. Haksever B, Soylu C, Micoogullari M, Baltaci G. The Physical Characteristics and Performance Profiles of Female Handball Players: Influence of Playing Position. European Journal Of Human Movement. 2021(46):37-49.
13. Oagaz H, Schoun B, Choi MH. Performance improvement and skill transfer in table tennis through training in VR. IEEE Transactions on visualization and computer graphics. 2021 Jun 3.
14. Petri K, Emmermacher P, Masik S, Witte K. Comparison of response quality and attack recognition in karate kumite between reality and virtual reality–a pilot study. International Journal of Physical Education, Fitness and Sports. 2019;8(4):55-63.
15. Lobato DF, Teixeira VA, Froes I, Donzeli MA, Bertoncello D. A comparison of the effects of plyometric and virtual training on physical and functional performance: a randomized, controlled, clinical trial. The Journal of Sports Medicine and Physical Fitness. 2020 Jul 28,61(1):27-36.

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A Study to Assess Prevalence of Developing Work Related Musculoskeletal Disorders Among Nursing Students at KPGU University – A Cross Sectional Study

Pratiksha Rajpurohit[1*], Pragna Landge[2] , Jahanvi Kayasth[3]

[1,3]pg Scholar (Neurological & Psychosomatic Disorders) Kspr, Kpgu, Vadodara, Gujarat, India, [2]Associate Professor (Adult Neurological & Psychosomatic Disorders) KSPR, KPGU, Vadodara, Gujarat India

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ABSTRACT

Background: Work-related musculoskeletal disorders (WRMSDs) present as pain or discomfort in the musculoskeletal system that individuals experience from work-related activities. Substantial research evidence exists on qualified nurses with WRMSDs, but there is a distinct lack of research regarding nursing students and their work environment in Vadodara. The aim of the study was to find out the prevalence of musculoskeletal disorders among nursing students in Vadodara.

Methodology : A cross sectional study involving a self administered questionnaire was initiated among the undergraduate nursing students at the KPGU University, Vadodara. All 100 undergraduate nursing students were given the opportunity to participate by completing the questionnaire. Data analysis consisted of frequencies, descriptive and custom tables. The Chi-square test for association was used to test the associations between variables

Result: The study found a 60% prevalence of MSDs. Musculoskeletal disorders occurred most commonly in the lower back (46%), neck (12%) and shoulder(10%), ankle/feet(17%) regions.

Conclusion: At the Drs Kiran and Pallavi Patel Global University (KPGU), there is a high frequency of MSDs (60%) among undergraduate nursing students. The highest prevalence rate for lower back pain during the past 12 months was observed.

Keywords: Nursing students, work related musculoskeletal disorders, KPGU university.

INTRODUCTION

Musculoskeletal disorders that occur from a work-related event are known as work related musculoskeletal disorders (WMSDs).[1] Manual lifting, frequent bending/twisting, using too much power, and poor working posture are all risk factors for WMSDs.[2] Repetitive Motion Injuries (RMI), Cumulative Trauma Disorder (CTD), and Repetitive Strain Injuries (RSI) are all terminologies that have been used to refer to WRMSDs.[3] The World Health Organization (WHO) states that when the working activities and conditions are significantly increased, Work-related musculoskeletal disorders (WMSDs) exacerbate.[4] This can result in symptoms like pain, burning, numbness, and/or tingling, which can reduce productivity and it affects working hours. When these factors are properly assessed and addressed, the disorders are frequently resolved when no treatment is received, symptoms may begin as intermittent and mild and then worsen with time and lower

Corresponding author: Pratiksha Rajpurohit, Pg Scholar, Neurological & Psychosomatic Disorders, KSPR,KPGU

Email: Rajpurohitp196@Gmail.com,

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limbs which typically result from a combination of physical factors (such as repetition, force and awkward postures) as excessive work rates or durations, inadequate breaks, and a variety of psychosocial workplace characteristics). When these factors are properly assessed and addressed, the disorders are frequently resolved.[5] Ergonomic issues in the lower back are related to heavy lifting and repetitive trunk bending. Twisting or bending the neck while also twisting, raising, and abducting the shoulders for extended periods of time is a common cause of neck disorders.[6]

Nurses who work in hospitals are more susceptible to occupational health risks than other healthcare professionals.[6] They are an integral part of the healthcare team, as they bridge the gap between doctors and patients, and facilitate healthcare delivery in hospitals. Female nurses are more liable to endure WRMSDs, as they are also fulfilling responsibilities after work, including taking care of children and household work, with insufficient rest time and a lack of exercise.[(7)] College students have just begun to experience MSDs as a public health issue, with different regions of the world reporting prevalence rates ranging from 32.9% to 89.3%.[8] Musculoskeletal diseases are more common on an annual basis, according to studies in at least one human body part and/or region that varied between 40 and 95% in a sample of Asian nurses. In Western populations, the low back, neck, and shoulders are the most severely affected body parts, with prevalence of 29-64%, 34-63%, and 17-75%, respectively.[(7)] The most common WRMSDs found in nurses are lower back, ankle, knee, shoulder, neck, hand and wrist pain, with lower back pain being the most prevalent. Foot and ankle injuries are the second-most common MSD among nurses. Nearly half of the time that nurses are on their feet is spent moving between wards.[6]

Nursing is a type of profession which is highly engaged in patients care. And as there is scarcity of literature available about the prevalence of WRMSDs among undergraduate nursing students Hence there is need arise to evaluate the prevalence of WRMSDs (According to WHO). This will help us to create proper ergonomic posture in their health care practice.

METHODOLOGY

Sampling and population

Ethical Approval was obtained from institute committee. An informed consent was obtained in the first page of the study's questionnaire. A convenient sampling method was used to choose 100 undergraduate nursing students. This sampling method was used for all the undergraduate nursing students at the KPGU University were given the opportunity to participate. Inclusion criteria included Male and female KPGU university Nursing students between the ages of 18 and 25 year old and students who were willing to participate in a study. Those with a history of TKR surgery or musculoskeletal injury from an accident are excluded.

Data Collection

A self-reporting questionnaire with 8 questions was prepared and distributed to nursing students in Vadodara that covered personal factors, basic demographics like age, gender, and academic year in order to answer the research questions. The questionnaire mainly focused on the prevalence of MSDs. In these studies, the key concepts were related to the presence or absence of pain, duration, location and frequency of pain. Students were also asked to rate their level of pain on a scale of 0 to 10, with 0 denoting "no pain at all" and 10 denoting "the worst pain they have ever experienced". The survey was prepared in online form through Google Forms. The questionnaire is distributed via whatsapp group given the internet link of online form to the nursing students.

Data Analysis

Continuous data are presented as mean ± standard deviation, whereas categorical data are presented as frequencies and percentages. Continuous data were compared using unpaired t-test and categorical data by Chi-square test. In all statistical tests, a value of $p<0.05$ was considered significant

RESULT

Demographic characteristics : Out of 100 participants 70 (70%) were female and 30 (30%)

were male, and mean age was 21.15 years (SD = 0.70). Out of all academic years third year students were more exposure to clinical hours.

Intensity, frequency and type of pain

Table 1 showed pain score of 3.81 (SD=2.081) and experiencing deep and dull acing pain (64%) mostly during clinical work(55%).

Table 1 characterize pain according to pain frequency,perception

Intensity of pain	Mean/SD
0-10	3.81/2.08
Frequency of pain	Percentage
Daily	12%
Weekly	21%
Monthly	14%
During work	53%
Type of pain	Percentage
Throbbing	12%
Deep and dull aching	64%
Pin pricing	9 %
Tingling and numbness	13%
Sharp shooting	2%

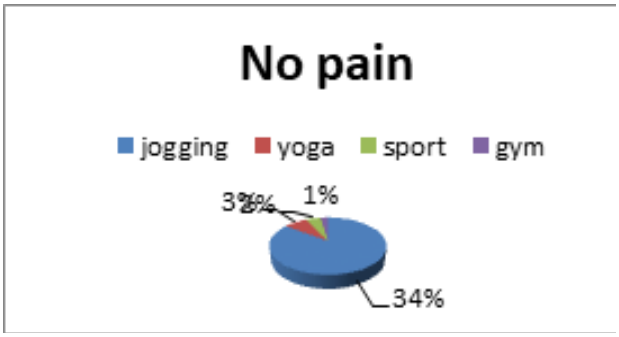

Fig. 1:

Correlation Between Pain And physical activity Perform :-

Figure1 showed Out of 100 undergraduate students, 60 students report having pain, whereas the remaining 40 do not. 60 students (16%) engaged in walking, running, or jogging, yoga (19%), sports activity (15%), and gym exercise (10%).

Correlation between pain and type of work

With the use of the chi squared test it was determined that out of 30 (14%) of students with long-standing clinical hours experienced lower back discomfort, with a significance level of $p<0.0001$. Ankle/feet (9%) was the second-most painful body part, with a significance level of $p<0.0001$.

Table 2: Show physical activity and WRMDS in different body region

1.Do you perform exercise ?	Percentage
Yes	56%
No	44%
2. Type of exercise ?	Percentage
Walking/ running/jogging	65%
Yoga	16%
Gym activity	8%
Playing sports	10%
3.Type of activity perform most of the time	Percentage
Using electronic gadgets	11%
Sitting prolong period of time during lectures	26
Long standing hours in laboratory /clinic	30
Preparing lecture note	10
Prolong sitting and reading	23
4.Prevalence of musculoskeletal disorders during last 12 month:-	Percentage
Lower back	46%
Ankle/ankle	17%
Neck	12%
Shoulder	10%
Knee	9%

DISCUSSION:

At the Drs. Kiran and Pallavi Patel Global University Varnama, Vadodara, a study was conducted to identify the prevalence of MSDs among undergraduate nursing students. Several nursing student between the ages of 18 and 25 Participated in the study. Surprisingly, a substantial 60% of the group had an overall MSD prevalence.

Less clinical hours are posted by first and second year students than by third year students. Third-year students have more back and ankle pain due to a lack of knowledge regarding ergonomic posture during clinical posting hours.

Consequently, from first-year students should get instruction on how to maintain ergonomic posture while moving patients or performing other tasks related to patient care. Additionally, it is said that among nursing students, back pain is the most prevalent musculoskeletal problem(46%). Furthermore, some claimed that standing posture, work habits, and other demographic traits could be connected to the frequency and location of pain as well as other symptom.

The sample of nursing students in the current study demonstrated a significant prevalence of pain and discomfort in various body regions. The lower back (46%), neck (12%), shoulder(10%), ankle and foot (17%), and knee(9%) were the body parts with the highest prevalence rates over the past 12 months. However, a common trend amongst all the studies as well as in current study, back pain is the most common type of chronic pain.[9] According to research on working professionals in general, lower back pain is frequently correlated with occupational, organizational, lifestyle, and psychosocial aspects.[10]

Based on the above results, it has been determined that out of 100 people (40%) who do not experience any pain conduct daily walking, jogging, or running (34%). This is after comparing the relationship between pain and physical activity performance. In considering this, the study suggests that WMSD is less common in those who engage in daily physical exercise like walking, jogging, or running.

The second association between pain and the sort of maximal work performed by the population indicates that the highest proportion was observed in long standing hours in hospitals and clinics (30%), with 14% and 9% of those complaining of lower back and ankle/feet pain, respectively.

In the past year, more than one-third of the nursing population under study have experienced WRMSDs in the ankles or feet. Comparatively, the prevalence was lower than those recorded in Australia (55.3%) and Iran (59.0%). However, Saudi Arabia (41.5%) and China (34.4%) saw greater prevalence rates than their international equivalents. As part of their duties, nurses had to walk a lot and stand for extended periods of time. Although there are several factors that can contribute to the development of WRMSDs in the ankles and feet, the most well-known one is wearing improper footwear that lack of support (such as high heels, thin insoles) has increased the risk..

Similar research has found that women tend to have higher rates of MSDs than males do across disciplines.[11][12] For our investigation, this was also accurate. Men are underrepresented in the nursing profession, as well as in this sample group, thus it is important to keep this in mind when evaluating gender disparities. [11]

Following were a few limitations that were identified during the course of the study: The study relied on students' self-reports of their experiences with and opinions on MSDs. There is a chance that some students may not have been able to accurately recall all of their experiences and perceptions, making some of their responses to questions less reliable. The University of KPGU provided the sole sample for the study. Therefore, it cannot ensure that the conclusions may be applied to students enrolled in other universities or health programs.

CONCLUSION

The study concludes that, there is a high frequency of MSDs (60%) among undergraduate nursing students. The highest prevalence rate for lower back pain during the past 12 months was observed. The occurrence of these MSDs is influenced by a variety of factors as well. In order to prevent a spread of MSDs, it is our suggestion that educational interventions for managing and preventing work-related MSDs be provided to students.

Authors Contribution

All three authors contributed to the study's idea and design, data analysis and interpretation. In addition the first author helped with data collection and analysis.

Conflicts of Interest: None

Source Of Funding : Self

REFERENCES

1. Tinubu BM, Mbada CE, Oyeyemi AL, Fabunmi AA. Work-related musculoskeletal disorders among nurses

in Ibadan, South-west Nigeria: a cross-sectional survey. BMC Musculoskeletal disorders. 2010 Dec;11:1-8
2. Ibrahim RR. Musculoskeletal Discomfort Among Nurses. Internatinal journal of innovative science, engineering & technology,2019 Mar 7(3).
3. Amin NA, Nordin RB, Noah R, Oxley JA, Fatt QK. Work related musculoskeletal disorders in female nursing personnel: prevalence and impact. International Journal of Collaborative Research on Internal Medicine & Public Health. 2016;8(3):294-315.
4. Heidari M, Borujeni MG, Rezaei P, Abyaneh SK. Work-related musculoskeletal disorders and their associated factors in nurses: a cross-sectional study in Iran. The Malaysian journal of medical sciences: MJMS. 2019 Mar;26(2):122.
5. Syed Abudaheer K, Rongle C, Kutty RK, Narayanan Muthukumran N, Jayaraman M, Russel SS, Nedunchezhiyan A. Work-Related Musculoskeletal Symptoms among Academicians in Malaysian Universities. Medico-legal Update. 2020 Oct;20(4):1211.
6. Moodley M, Ismail F, Kriel A. Work-related musculoskeletal disorders amongst undergraduate nursing students at the University of Johannesburg. Health SA Gesondheid. 2020;25.
7. Krishnan KS, Raju G, Shawkataly O. Prevalence of work-related musculoskeletal disorders: Psychological and physical risk factors. International journal of environmental research and public health. 2021 Sep 4;18(17):9361.
8. Abledu JK, Offei EB. Musculoskeletal disorders among first-year Ghanaian students in a nursing college. African health sciences. 2015;15(2):444-9.
9. Moodley R, Naidoo S. The prevalence of musculoskeletal disorders among dentists in KwaZulu-Natal. South African Dental Journal. 2015 Apr 1;70(3):98-103.
10. Alghwiri A, Marchetti G. Occupational back pain among schoolteachers in Jordan: estimated prevalence and factors associated with self-reported pain and work limitations. International Journal of Occupational Safety and Ergonomics. 2018 Jul 3;24(3):341-6.
11. Jellad A, Lajili H, Boudokhane S, Migaou H, Maatallah S, Frih ZB. Musculoskeletal disorders among Tunisian hospital staff: Prevalence and risk factors. The Egyptian Rheumatologist. 2013 Apr 1;35(2):59-63.
12. Ng A, Hayes MJ, Polster A. Musculoskeletal disorders and working posture among dental and oral health students. InHealthcare 2016 Jan 23 (Vol. 4, No. 1, p. 13). MDPI.

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The Effectiveness of Toe Flexor Strengthening on Balance and Risk of Fall in Patients with Diabetic Polyneuropathy- A Pilot Study

Saifuddin Khand[1*], Pragna Landge[2]

[1]PG Scholar (Neurology & Psychosomatic Disorders) KSPR, KPGU, Vadodara, Gujarat, India,

[2]Associate Professor (Neurology & Psychosomatic Disorders) KSPR, KPGU, Vadodara, Gujarat, India

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ABSTRACT

Background: Diabetic polyneuropathy (DPN) is relatively common complication of long-term diabetes and is thought to be progressive and irreversible. The loss of sensations associated with Diabetic polyneuropathy is thought to contribute to impaired balance and increased risk of falling. Reduced toe flexor strength is an independent predictor of falls. However, it is unknown whether strengthening programs can restore toe flexor strength in patients with DPN.The aim of this study was to investigate whether a progressive resistance training program, focused specifically on the foot & toe flexor muscles, could improve toe flexor strength in patients with DPN.

Methods: A total of 20 patients were allocated into two groups of 10 each. Group A receive 12 sessions of (Conventional physiotherapy & Modified toe training programme) and Group B (Conventional physiotherapy & General toe exercise). Berg balance score (BBS), Fall efficacy scale international (FES-I) & Time up and go test (TUG) were measured on first day (Week 1) and last day (Week 4) of intervention. Pre-test and post-test scores were compared and results were tabulated.

Result: Both groups showed significant improvement in balance performance. The Group A showed statistically significant improvement in static & functional balance when compared to Group B.

Conclusion: The study demonstrated a significant improvement in balance and functional mobility was seen among Group A.

Keywords: Diabetic polyneuropathy, Toe flexor strengthening,BBS,FES-I,TUG.

INTRODUCTION

Diabetes mellitus (DM) is a fast growing chronic metabolic disorder resulting from a defect in insulin secretion, insulin action or both. According to predictions from 2019, 77 million people in India had diabetes, and by 2045, that number is predicted to reach over 134 million.DM is the most common endocrinal disorder in which insulin deficiency results to persistent hyperglycemia with disturbance of carbohydrate, fat, and protein metabolism. As the condition worsens, tissue or vascular damage occurs, which can cause serious diabetic side effects such as impairment of immune system, retinopathy, neuropathy, nephropathy, cardiovascular problems, somatic and autonomic neuropathy, diabetic foot and ulceration.[1-3] Diabetes has an impact on the peripheral nervous system, and the most frequent complication of diabetes is diabetic polyneuropathy(DPN).\\

The prevalence of DPN ranges from 2.4% to 78.8% worldwide and the risk factors

Corresponding author: Saifuddin Khand, PG Scholar (Neurology & Psychosomatic Disorders) Kspr, Kpgu, Vadodara, Gujarat, India

Email: Saifuddinkhand40@gmail.com

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include age, male gender, chronicity of diabetes, uncontrolled glycaemia, overweight and obesity, insulin treatment, smoking and hypertension.[4, 5]

The most frequent symptoms therefore seen are sensory and motor in character; as a result, patients frequently complain of pain , signs of discomfort such as burning pain, sharp shooting pain, feeling of numbness, extreme sensitivity to touch and the glove and stocking distribution in the distal part of hand and feet.[6] When the condition worsens, patients may experience motor [system] involvement, like wasting of interossei in hands, weakness and atrophy within feet and lower extremity, slower movement of feet, unstable gait, diminished reflexes, postural instability, anxiety, depression and frequent fall. [7]

Currently, diabetic peripheral neuropathy is most frequently blamed for older persons with type 2 diabetes' with decreased balance and accompanying higher risk of falling (DPN) [8]. The incidence rate of falls in elderly individuals with diabetes is 78% as compared to 30% in healthy elderly individuals; further, the fall risk rate 11.5 times higher in elderly patients with DPN than in normal people.[9] Maintaining balance is a difficult skill that requires thecombination of numerous sensorimotor and cognitive processes, and age-related decline in both the sensorimotor and cognitive systems can impair the balance ability, hence for older persons with type 2 diabetes fall must be reduced to maintain independency, quality of life, and physical function[8]. The abundance of literature proposed that physical therapy [aerobic exercise, resistance exercise or both] play a major role in controlling blood glucose level, decreasing body weight, improving muscle quality, gait, balance and QOL in patient suffering from DPN. [9]

The primary role in balance is recognized by large muscle groups, such as the trunk, hips, knees and ankles, but the contribution of the toe flexor muscles to the integrated physiological balance systems throughout the body is less understood. Each of the ten toe flexor muscles contributes to motion of the foot when leg is free in space and when in contact with the supporting surface. Each muscle is classified as extrinsic - with muscle bellies in the posterior lower leg, or as intrinsic - with muscle bellies within the plantar aspect of the foot.

In the upright position, there is an adequate generation of a plantar flexor torque by the toe flexors which prevents the anterior displacement of the center of mass beyond the base of support. The toe flexor Group actively contracts to stabilize the foot in response to constricting Muscle strength becomes more active with increased postural control demands while standing on one leg and while walking [10].The current study will be designed with the goal of comparing the effectiveness of general toe exercises or modified toe training programme along with conventional therapy in addition to diabetic polyneuropathy patients to improve balance and reduce the risk of fall.

METHODOLOGY

20 patients were recruited from shivay hospi care and Vallabh hospital Vadodara based on inclusion criteria. Patients were without severe cognitive or physical impairment (i.e., they were able to walk and transfer independently). Written informed consent was taken from all the patients who actively agreed to participate in the study. Patients were allocated randomly in 1:1 ratio either of modified toe training programme or general toe exercise in DPN patient.

Conventional therapy was remaining same in both the groups and baseline data were obtained. Before intervention Berg balance score [BBS], fall efficacy scale international [FES-I] & Time up and go [TUG] test were noted. Both the groups were given intervention of 12 sessions in 4 weeks. (3days/week). Post intervention again data were obtained for BBS,FES-I& TUG.

Inclusion criteria[11] for the study were Age 55 to 75 year old Patients diagnosed with DPN and referred by diabetologist, ability to understand instruction, Patient who actively participate in the study

Exclusion criteria[11] Patient who experienced pain or having symptoms of rheumatoid arthritis, Impairment of central and peripheral nervous system, Taking medication that could impact stability of patient during Treatment,

Lower extremity complications such as fracture , experienced dislocation in lower limb at least six months prior to the study , having history of surgical operation in muscles, bones, and joints of lower extremities, THR, AVN, TKR, and knee joint flexion contracture, interruption of the intervention for more than two sessions.

INTERVENTION[12, 13]

Group A: Patients received conventional physiotherapy + modified toe training exercise programme.

Group B: Patients received conventional physiotherapy + general toe exercise.

CONVENTIONAL THERAPY: -

- Relaxed deep breathing exercise.
- Range of motion exercises for ankle joint.

Static Balance trainingexercise

- Standing and hip flexion along with knee flexion for 10 seconds hold in each leg [5 times].
- Standing and hip extension for 10 seconds hold in each leg [5 times].
- Standing and side leg raise for 10 seconds hold in each leg [5 times].

Functional balance training:

- Sit to stand [5 times].
- Standing weight shift [5 times].
- Functional reach sideward and forward for touching targets set by the therapist [5 times].
- Bilateral heel rise for 20 seconds [5times].
- Unilateral standing 15 seconds [5 times].

Gait Training:

- Tandem walking.
- Spot marching.

GENERAL TOE EXERCISES: -

It consisted of eight general foot exercise that have no resistance which include general toe exercisesthat is toe squeezes, toe pulls, marble pickup and towel pulls and the short foot exercise and at last cool down phase consisted of rolling a ball underneath each foot for 2 minutes.

TOE TRAINING EXERCISE PROGRAMME:

Short foot exercise: - Patient will be asked to raise his arch of foot by sliding his big toe toward his heel without curling his toes or lifting his heel [3 x 5 reps on each foot, holding position for 5 sec. And later progression to 5x5 reps on each foot, hold for 10 sec.]

Toe flexion: - Theraband was placed over the sole of patient foot with one end under the heel and the alternative was over the toes and, patient was asked to keep foot in neutral position and flexed his toes downward into the band. Hold and slowly return back to normal position [2 x 10] yellow band, later progresses to [2 x 10 blue band].

Hallux flexion: -Same as above but the therabandwas wrap solely around patient's big toe. [2 x 10 yellow band later progressed to 2 x 10 blue band].

Big toe pull:- Band was placed around patients big toes and hold the end of bands in opposite hands. Patient's heel will remain on ground only and patient was asked to pull his big toes away from each other or towards the little toes. [1 x 10 yellow band, hold for 5 seconds, later progressed to 1 x 10 blue band].

1**COOL DOWN PHASE** [3 - 5 MIN]:- plantar fascia stretch.

OUTCOME MEASURES[14,15]

BBS [BERG BALANCE SCORE]

Berg Balance Score is used to test static and dynamic balance. Patient were asked to fill 14 item scale which were containing simple task, after each task scoring were done from 0 [unable to perform task] to 4 [Independent performing task]. At last summing of all score was performed. Lower score indicate severe balance impairment.

FES -I [FALL EFFICACY SCALE – INTERNATIONAL]

It is used to measure falling likeliness. Patients were asked to fill self 16 item questionnaire related to routine work. Score range from minimum 1 [means not concerned] to maximum 4 [very concerned].Higher the score of FES-I indicate more chances of fall.

TUG [TIME UP AND GO TEST]-

It is used to screen for balance problems in older people. The TUG test consist of the participant getting up from a chair, walk 3m, turning at a designed spot, returning to the seat and sitting down. The time taken to perform the test was measured using stopwatch.

STATICALLY ANALYSIS

Descriptive statically analyses obtain use in zrequency, percentage, mean, SD, CI, median & IQR. Paired t-test use for the comparison of pre and post data within group. Unpaired t-test was used for the comparison of data between Group-A & Group-B. All the statically analysis wasperformed by using IBM SPSS version 29.0.0.

RESULT

Table 1 depicts pre & post comparison of mean SD of BBS , FES-I & TUG score between Group A & Group B

0A significant improvement was found in the group A of age (68.73±4.42) in which total number of (male-2 & female-8) who received conventional physiotherapy &Modified toe training programme (42.8±4.70 in BBS) compared to Group B of age (69.5±3.43) in which total number of male-4 & female-6) who received conventional physiotherapy & general toe exercise (37.2±3.79 in BBS) (p<0.0089) considering significance level at p<0.0 Followed by 4 week period for both the group.

Significant effects were found for single leg standing balance with eyes open & reach out activities in modified toe training programme group whereby there was less effect was seen in the Control group.

A positive significant improvement was found post intervention in item 11(walking on a slippery surface), followed by items 14 and 15 in FES-I in group A [33.4±5.58], when data were combined from both the groups, FES-I were not significantly improved in the group B (40±6.46) (P<0.025) considering significance level at p<0.05.

In TUG both the groups showed a significant improvement, indicating a better improvement in dynamic balance ability. however, there was a greater improvement seen in TUG performance in GROUP A (17±2.49) who received modified toe training programme compared to group B (19.4±5.03) who received general toe exercise (P<0.19) considering significance level at p<0.05.

DISCUSSION

The aim of the study was to investigate the effects of conventional balance training along with toe training programme and conventional balance training along with general toe exercise on static and dynamic balance and fall efficacy in patients with diabetic neuropathy.

The result of the present study findings showed that both the treatment protocol shows improvement in dynamic and static balance abilities (BBS, FES-I and TUG), but toe training programme is more effective protocol to improve static and dynamic balance significantly and reduce risk of falling after toe flexor strengthening.

Individual's balance is a complex multidimensional concept related to postural control, which essentially refers to the ability to maintain posture (e.g. sitting or standing), to move between postures, and to not fall when responding to external disturbances, balance and strength training can help prevent two-thirds of falls and even fatalities .[16.]

The toe flexor muscles perform a crucial function to control foot movementand assist with the propulsive force when walking. This is

Table 1: Comparison of pre and post mean SD of BBS, FES-I and TUG of both the groups

	BBS		FES-I		TUG	
	Pre	Post	Pre	Post	Pre	Post
Group-A	31±5.73	42.8±4.70	39.6±6.83	33.4±5.58	20.9±2.72	17±2.49
Group-B	30.4±4.83	37.2±3.79	42.9±5.91	40±6.46	21.5±4.03	19.4±5.03
p-value	0.80	0.0089	0.26	0.025	0.70	0.19

achieved by the contraction of the muscles at the late stance phase in the gait cycle, it was estimated that the muscles of the flexor hallucis longus, brevis, flexordigitorum longus and brevis exert forces of approximately 52%, 36%, 9% and 13% of body weight during propulsion, respectively.[17]

According to Shogo Misuit et.al it was demonstrated that aging is associated with reduced toe flexion strength, and that toe deformities were associated with weak toe flexor strength. In addition, older people with reduced toe flexor strength had impaired balance function and a higher risk of fall.[17]

Our study also supports Koutatsu Nagai, RPT, MS et al whose purpose of this study was to investigate the effects of toe and ankle training for the elderly to improve Muscle strength, physical function and fear of falling. A significant improvement was found in quadriceps strength, functional reach and possible improvement in toe flexor force. This approach may help elderly individuals to maintain their activity level without increasing risks.[18]

These results indicate an important contribution of toe function to dynamic balance. The functional reach test includes a forward shift of the center of pressure. Improvement in toe function could be one of the factors involved in the increase in reach distance in the present study.[18]

Our study also support Hiroaki Kataokaa et al whose purpose of study was to investigate the effect of short-term toe resistance training on Toe Pinch Force in patients with T2DM, and demonstrated significantly increased the TPF in the T2DM patients. Toe resistance training is thus recommended in clinical practice for patients[19]

Our study also supports Alletet al. This showed that functional balance and walking ability are significantly increased by a combination of resistance training, balance training, and walking for 12 weeks 20.

Our study also support Richardson et al who reported that the results of single-leg standing and functional reach test were

Significantly improved for 3 weeks by resistance training and balance training in patients with T2DM with diabetic neuropathy. These results suggest that physical therapy could improve motor function in patients with T2DM.[21.]

CONCLUSION

In conclusion, the study demonstrated a significant improvement in balance and functional mobility among participants who received the toe training program alongside conventional physiotherapy (Group A) compared to those who received general toe exercises with conventional physiotherapy (Group B). Group A showed significant enhancements in Berg Balance Scale (BBS) scores, particularly in single leg standing balance with eyes open and reach out activities. Moreover, Group A exhibited positive significant improvements in specific activities related to fear of falling (FES-I items 11, 14, and 15) and performed better in the Timed Up and Go (TUG) test, indicating superior dynamic balance abilities. These findings emphasize the effectiveness of modified toe training program in enhancing balance, functional mobility, and reducing the fear of falling in the studied population.

CLINICAL IMPLICATION

Including modified toe training exercises in conventional treatment programme can substantially benefit patients by improving their balance and reducesrisk of fall among diabetic polyneuropathypatients.

Limitation of the study

Small sample size and short period of intervention

Future scope: Future research with more sample size and long period of intervention.

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Conflicts of interest: None

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Ethical approval: Approval was taken from ethical committee.

ABBREVATIONS

DM: Diabetes Mellitus

DPN: Diabetic Polyneuropathy

BBS: Berg Balance Score
FES-I: Fall Efficacy scale International
TUG: Time Up & Go Test

REFRENCES

1. Bastaki S. Diabetes mellitus and its treatment. Dubai Diabetes and Endocrinology Journal. 2005 Mar 1;13(3):111-34.
2. K aul K, Tarr JM, Ahmad SI, Kohner EM, Chibber R. Introduction to diabetes mellitus. Diabetes: an old disease, a new insight. 2013:1-1.
3. Pradeepa R, Mohan V. Epidemiology of type 2 diabetes in India. Indian journal of ophthalmology. 2021 Nov;69(11):2932.
4. Román-Pintos LM, Villegas-Rivera G, Rodríguez-Carrizalez AD, Miranda-Díaz AG, Cardona-Muñoz EG. Diabetic polyneuropathy in type 2 diabetes mellitus: infl ammation, oxidative stress, and mitochondrial function. Journal of diabetes research. 2016;2016.
5. Papanas N, Ziegler D. Risk factors and comorbidities in diabetic neuropathy: an update 2015. The review of diabetic studies: RDS. 2015;12(1-2):48.
6. Alam U. Diabetic neuropathy collection: Introduction to diabetic neuropathy. Diabetes Therapy. 2020 Apr;11:755-60.
7. Andersen H. Motor neuropathy. Handbook of clinical neurology. 2014 Jan 1;126:81-95.
8. Hewston P, Deshpande N. Falls and balance impairments in older adults with type 2 diabetes: thinking beyond diabetic peripheral neuropathy. Canadian journal of diabetes. 2016 Feb 1;40(1):6-9.
9. Kaur J, Singh SK, Singhvij J. Physiotherapy and rehabilitation in the management of diabetes mellitus: a review. Indian Journal of Scientific Research. 2015;6(2):171-81.
10. Quinlan S, Yan AF, Sinclair P, Hunt A. The evidence for improving balance by strengthening the toe flexor muscles: A systematic review. Gait & Posture. 2020 Sep 1;81:56-66.
11. Stolarczyk A, Jarzemski I, Maciąg BM, Radzimowski K, Świercz M, Stolarczyk M. Balance and motion coordination parameters can be improved in patients with type 2 diabetes with physical balance training: non-randomized controlled trial. BMC Endocrine Disorders. 2021 Dec;21(1):1-9.
12. Mickle KJ, Caputi P, Potter JM, Steele JR. Efficacy of a progressive resistance exercise program to increase toe flexor strength in older people. Clinical Biomechanics. 2016 Dec 1;40:14-9.
13. Ajitha M. Effectiveness of stability trainer exercises over conventional physiotherapy on balance re-education in patients with type 2 diabetic peripheral neuropathy.
14. Timar B, Timar R, Gaiţă L, Oancea C, Levai C, Lungeanu D. The impact of diabetic neuropathy on balance and on the risk of falls in patients with type 2 diabetes mellitus: a cross-sectional study. PloS one. 2016 Apr 27;11(4):e0154654.
15. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. Physical therapy. 2000 Sep 1;80(9):896-903.
16. Fangxin WE, Ziqi HU, Ruiyao HE, Yu WA. Effects of balance training on balance and fall efficacy in patients with osteoporosis: A systematic review and meta analysis with trial sequential analysis. Journal of rehabilitation medicine.2023:55
17. Misu S, Doi T, Asai T, Sawa R, Tsutsumimoto K, Nakakubo S, Yamada M, Ono R. Association between toe flexor strength and spatiotemporal gait parameters in community-dwelling older people.journal of neuroengineering and rehabilitation 2014 dec;11:1-7
18. Nagai K, Inoue T, Yamada Y, Tateuchi H, Ikezoe T, Ichihashi N, Tsuboyama T. Effects of toe and ankle training in older people: a cross-over study. Geriatrics & gerontology international. 2011 Jul;11(3):246-55.
19. Kataoka H, Miyatake N, Murao S, Tanaka S. A randomized controlled trial of short-term toe resistance training to improve toe pinch force in patients with type 2 diabetes. Acta Medica Okayama. 2018;72(1):9-15.
20. Allet L, Armand S, De Bie RA, Golay A, Monnin D, Aminian K, Staal JB, de Bruin ED. The gait and balance of patientswith diabetes can be improved: a randomised controlled trial. Diabetologia. 2010 Mar;53 :458-66.

Clinical Trial

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The Mckenzie Methodwith Interferential Therapy on Acute Low Back Pain (Sciatica) Patients: A Randomised Controlled Clinical Trial

Sedhuraja Malaichamy[1], Meghana Palkhade[2*], Charusmita Badgujar[3], Satyajit Kumbhar[4]

[1]Professor, SVJCT's BKL WalawalkarCollege of Physiotherapy, Sawarde, Ratnagiri District, Maharashtra, India [2]Associate Professor, SVJCT's BKL Walawalkar College of Physiotherapy, Sawarde, Ratnagiri District, Maharashtra, India, [3,4]Assistant Professor, SVJCT's BKL Walawalkar College of Physiotherapy, Sawarde, Ratnagiri District, Maharashtra, India,

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ABSTRACT

Purpose: To investigate the effect of McKenzie method withInterferential therapy (IFT)when compare to IFT alone on acute low back pain (Sciatica) patients in terms of relieving pain, increasing lumbar extension range of motion and speed of walking.

Methods: Randomised controlled clinical trial,fifty seven patients were screened; forty sciatica patients aged from 30 to 60 years with no recent injury were selected through the special tests, after randomisation, the experimental group (n-15) was treated with the McKenzie method andInterferential therapy whereas control group (n-15) was treated with the Interferential therapy alone. The primary outcome was the relief of low back pain and increasing the lumbar extension range of motion. The secondary outcome was the speed of walking by measuring the stride length and cadence for 10 meters.

Result: The study aimed to compare the pain, lumbar extension range of motion (ROM), stride length, and cadence of two different teams before and after physiotherapy. The experimental team had an average pain score of 7.70 VAS, a lumbar extension range of motion of -3.70 degrees, a stride length of 56.70 cms, and a cadence of 115.35 steps. In post-physiotherapy, the team had an average pain score of 2.20 VAS, a lumbar extension range of motion of 24.85 degrees, a stride length of 58.65 cms, and a cadence of 113.15 steps. The mean difference in pain, ROM, stride length, and cadence was statistically significant. The results suggest that physiotherapy can be a valuable tool for improving pain management and reducing back pain.

Conclusion: McKenzie method with Interferential therapy showed greater relief of low back pain, increased lumbar extension range of motion, increased speed of walking in terms of step length and cadence than IFT alone.

Keywords: McKenzie method, Interferential Therapy, Acute Low back pain (Sciatica) Patients.

INTRODUCTION

Sciatica is a chronic condition that results in excruciating low back pain that spreads to the posterior thigh, where the sciatic nerve is innervated. It continues to be a significant global public health issue with serious socioeconomic, physical, and psychological effects. Due to the lack of agreement on diagnostic and treatment guidelines, studies suggested various diagnostic methods. When it comes to management and treatment, there is conflicting evidence regarding the use of

Corresponding author: Meghana Palkhade, Associate Professor, SVJCT's BKL Walawalkar College of Physiotherapy, Sawarde, Ratnagiri District, Maharashtra, India.

Email: drmeghana4280@gmail.com,

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painkillers, surgical interventions, and alternative options as well as their efficacy, with the majority of studies contrasting one another in addition to the dearth of high-quality trials[1]. Depending on the population, sciatica is a relatively common musculoskeletal disorder with a prevalence of 2–5%. It results in high societal health-related costs and a high disability burden for people with sciatica [2].Lumbar disc herniation (LDH)-related pain is usually more severe than non-specific lumbar pain. Patients with LDH had greater pelvic rotation when walking, and the relative phase of the horizontal rotation of pelvis and thorax decreased compared with healthy persons[3]. Pain intensity can affect the spatiotemporal gait parameters in patients with Low back pain (LBP). Rehabilitation programs with gait optimization should be considered in the management of patients with LDH and Chronic mechanical low back pain(CMLBP)[4].

The McKenzie back exercises are a part of an exercise regimen developed in the 1950s by physiotherapist Robin Anthony McKenzie and made well-known around 1985. The Mechanical Diagnosis and Therapy (MDT), also known as the McKenzie method, is a classification system that is frequently used for the diagnosis and treatment of a number of musculoskeletal conditions, including lower back, neck, and extremity pain.The McKenzie method has wide acceptance as an effective program for back pain. It stresses self-treatment through posture correction and repeated exercise movements at end-range performed with high frequency. The McKenzie method emphasizes the centralization phenomenon in the assessment and treatment of spinal pain, in which pain originating from the spine refers distally, and through targeted repetitive movements the pain migrates back toward the spine. The clinician will then use the information obtained from this assessment to prescribe specific exercises and advise on which postures to adopt or avoid[5].

Short-term treatment of patients with low back pain in ***sub***- acute and chronic stage with the McKenzie method is more effective in reducing pain, and is more effective in sub-acute stage, increasing mobility and reducing pain.

Chronic low back pain patients need to be treated for longer periods, with the McKenzie Method.

Short-term treatment of patients with low back pain in sub-acute and chronic stage with the McKenzie method is more effective in reducing pain, and is more effective in sub-acute, increasing mobility and reducing pain. Chronic low back pain patients need to be treated for longer periods, with the McKenzie Method.[6] McKenzie therapy is an effective method for managing back pain in the short term (<3 months) compared with other therapies, but only through sound randomized controlled trials(RCTs) that will be able to determine the exact efficacy of McKenzie therapy.[7] In patients with low back pain, a meta-analysis of RCTs had been planned to compare physical therapy interventions with placebo or with no intervention. The primary outcomes would be pain intensity and disability. Finally, in chronic low back pain, the physical therapy exercise approach remains a first-line treatment and should be routinely used [8]. Within the McKenzie framework, Directional Preference (DP) exercises are commonly utilized in clinical practice for managing LBP. Although underpinned by a modest body of evidence, DP exercises have been shown to have positive effects in the management of LBP. Because the McKenzie method promotes self-management, the use of DP exercises, in conjunction with other common manual therapy treatments, such as mobilization, manipulation, and general exercise, may present a cost-effective and time-efficient approach to managing LBP.[9]

Interferential therapy combined with exercise therapy could help to reduce pain intensity and increase spinal range of motion in patients with low back pain[10].Interferential therapy combined with exercise therapy might be useful in treating low back pain.[11]

The primary outcome was the relief of low back pain and increasing the lumbar extension range of motion. The secondary outcome was the speed of walking by measuring the stride length and cadence for 10 meters. The purpose of this research study was to compare the effectiveness between the McKenzie method with Interferential Therapy group and the Interferential Therapy alone group among Sciatica Patients.

MATERIALS AND METHODS

Study Design

This was a randomized controlled clinical trial conducted among patients with acute discogenic sciatica.Before the commencement of this study, the institutional scientific and ethics committee of SVJCT's BKL Walawalkar College of physiotherapy, Sawarde, Maharashtra approvedon September 30, 2022 **(EC/NEW/INST/2020/320)**.

Intervention

The study included patients aged 30-60 with sciatica, positive for Lasegue's Test, Bowstring test, and Slump test. Exclusions included serious spinal pathology, neurological problems, severe osteoporosis, rheumatoid arthritis, anticoagulation therapy, dermatological conditions, epilepsy, patients with pacemakers, advanced cardiovascular conditions, hypotension, pregnant and lactating females, and those with epilepsy conditions.

The study involved 57 patients, with 17 excluded due to non-compliance criteria. The patients were divided into an experimental group and a control group. The experimental group received the McKenzie method with interferential therapy, which included various techniques for lumbar extension range of motion. The patient was then asked to walk on a marked floor for 10 meters to measure stride length and cadence.

The experimental group underwent the McKenzie method for 20 minutes, followed by interferential therapy for 30-40 minutes per day. The patient was asked to relieve pain by

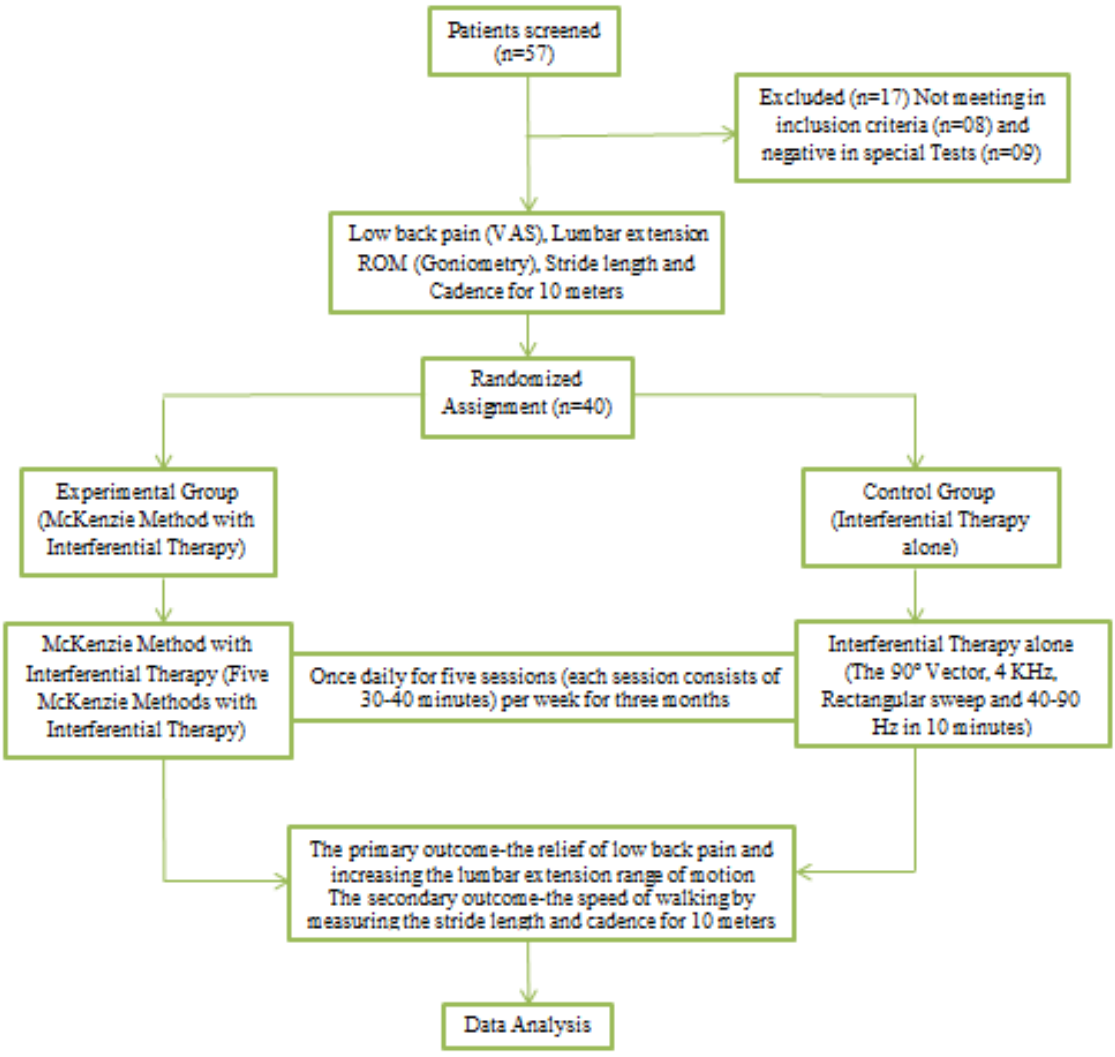

Fig. 1: Consort diagram illustrating the study design

scoring below 3 on the VAS scale. The control group received the conventional method of interferential therapy (IFT) using a BIONICA brand. The IFT consisted of dual channels, 3.4 kg weight, 4000 Hz frequency, and 230 volts. The patient was then asked to walk on the marked 10 meters distance on the floor to measure stride length and cadence. The study highlights the importance of standardized training protocols for both interventions in addressing low back pain.

The treatment lasting 30 to 40 minutes for one patient was given in once daily for five sessions per week. Both groups were taken with two types of treatments simultaneously for three months.

Data analysis

Collected data were entered in excel software and analysed used R software version 4.0.1. Continuous variables were presented as mean and standard deviation and categorical variables were presented as count and per cent. Paired t-test was done to compare the means between without windlass and with windlass. $P < 0.05$ was considered statistically significant.

Results

Out of 40 Patients, 20 (50%) male and 20 (50%) female patients took part in this study. Overall average age was 39.07 years.

The study analyzed patients treated with McKenzie Method with Interferential therapy, with an average age of 40.4 years. The patients experienced pre-physio pain of 7.70 and post-physio pain of 2.20, with a mean p value of 0.000. The average pre-physio extension ROM by Goniometry was -3.70 and 24.85, respectively. The average pre-physio stride length was 56.70 cms, and the average post-physio stride length was 58.65 cms. The average pre-physio cadence was 115.35 steps, and the average post-physio cadence was 113.15 steps. In contrast, the average age of the patients treated with Interferential therapy alone was 37.75 years. The pre-physio pain was 7.70, post-physio pain was 5.45, and the average pre-physio extension ROM was -3.00. The average pre-physio stride length was 56.75 cms, and the average post-physio stride length was 57.55 cms.

Table 1: Baseline characteristics of the sciatica patients

	Experimental Group		Control Group	
Characteristics	Average	SD	Average	SD
Age (Years)	40.04	0.41	37.8	0.26
BMI (Kg/m^2)	25.57	2.63	25.38	3.99

In Pre-Physiotherapy, in the low back pain outcome variable, the average pain for the experimental team was 7.70 VAS Score with a SD of 1.08 and for the control; the team was 7.70VAS Score with a SD of 1.08. The mean difference (p = 1.000) was statistically not significant. In the lumbar extension range of motion (ROM) outcome variable, the average extension ROM for the experimental team was -3.70degrees with an SD of 1.17 degrees and -3.00 degrees with an SD of 1.49 for the control team. For extension ROM, the mean difference (p = 0.107) was statistically significant. In the stride length variable, the average stride length for the experimental team was 56.70cms with a SD of 1.56 cms and for the control; the team was 56.75 cms with a SD of 1.86 cms. In terms of stride length, the mean difference (p = 0.927) was statistically significant. In the cadence outcome variable, the average cadence for the experimental team was 115.35 steps with a SD of 3.95 steps and for the control; team was 114.75 steps with a SD of 4.00 steps. For cadence, the mean difference (p = 0.636) was statistically significant.

In Post-Physiotherapy, in the low back pain outcome variable, the average pain for the experimental team was 2.20 VAS Score with a SD of 0.62 and for the control; the team was 5.45 VAS Score with a SD of 0.60. The mean difference (p = 0.000) was statistically significant. In the lumbar extension range of motion (ROM) outcome variable, the average extension ROM for the experimental team was 24.85 degrees with an SD of 1.35 degrees and 18.40 degrees with an SD of 1.35 for the control team. For extension ROM, the mean difference (p = 0.000) was statistically significant. In the stride length variable, the average stride length for the experimental team was 58.65 cms with a SD of 1.53cms and for the

control; the team was 57.55 cms with a SD of 1.70 cms. In terms of stride length, the mean difference (p = 0.038) was statistically significant. In the cadence outcome variable, the average cadence for the experimental team was 113.15 steps with a SD of 3.82 steps and for the control; team was 113.40 steps with a SD of 4.15 steps. For cadence, the mean difference (p = 0.844) was statistically significant.

DISCUSSION

The study was carried out to determine the effectiveness between McKenzie Method with interferential therapy and interferential therapy alone among the sciatica patients. The result of the present study showed that the McKenzie method with Interferential therapy reduced the intensity of low back pain, increased the lumbar extension range of motion andincreased the speed of walking in terms of stride length and cadence than interferential therapy alone. The strength of the study was that there were practice sessions and repetitions that were incorporated in the testing procedure.

A study found that comparing exercise prescriptions to patients with disc prolapse significantly decreased pain and medication use, improving overall outcomes, and has significant implications for LBP management[13]. Neurodynamic exercises to extension-oriented exercises for patients with nerve-related leg pain and a directional preference. As this study has a small and very specific sample, results may be interpreted with caution[14]. In two differentiated clusters,the two clusters were individualized regarding the temporo-spatial parameters (opposite foot contact, step width) as well as the kinematic parameters (maximum upward rotation in stance of pelvis, maximum adduction of the hip instance, maximum abduction of the hip in swing, maximum plantar flexion angle in swing, total sagittal plane excursion of the ankle).[15]

Acute low back pain with sciatica is a benign disorder that can be managed with passive physical therapy, medication, and therapeutic injections. Self-management techniques and exercise programs are effective, but the optimal regimen varies. Chronic low back pain requires aggressive, multidisciplinary management, including self-administered traction, corsets, and medications.[16] In patients with sciatica, centralization was common and associated with improvement in activity limitation and leg pain. Centralization was very common in ruptured disc therefore the study does not support the theory that centralization only occurs if the intra-discal hydrostatic mechanism was functional.[17]

For patients with low back pain, the McKenzie method of physical therapy and chiropractic manipulation had similar effects and costs, and patients receiving these treatments had only marginally better outcomes than those receiving the minimal intervention of an educational booklet. Whether the limited benefits of these treatments were worth the additional costs was open to question[18]. Exercise intervention programmes involving either muscular strength, flexibility or aerobic fitness was beneficial for Non-specific chronic low back pain (NSCLBP) but not acute low back pain. Non-specific acute low back pain patients recovered in 4–6 weeks with or without a treatment, and exercising should be avoided to reduce the swelling of the affected area[19].In patients with chronic nonspecific low back pain, both McKenzie and stabilisation exercises reduced functional disability more effectively than traditional exercise programmes.[20]

The interferential therapy combined with exercise therapy might be useful in treating low back pain.[21] The interferential therapy along with McKenzie extension bias exercisehad been positive impact in reducing pain, disability and spinal extensors muscle strength in patients with chronic low back pain.[22]

LIMITATIONS

This research study has a few limitations. Only 40 sciatica patients (smaller group) were participated due to time constraints.Only 10 meters distance (shorter distance) was available in outpatient physiotherapy department to measure the walking parameters of patients. Some patients were consumed with medications for low back pain.

CONCLUSION & SUGGESTIONS

This randomized controlled clinical trial demonstrated that the effectiveness of McKenzie method with interferential therapy was superior to that interferential therapy alone in reliving the low back pain, increasing the lumbar extension range of motion and improving the speed of walking in terms of increased step length and decreased cadence for 10 meters. No serious adverse events occurred in either group. This McKenzie method with interferential therapy may help the sciatica patients from unwanted and unnecessary surgeries in their life span. Further studies are needed to examine the effectiveness of McKenzie method relative to various physical therapy methods for patients with discogenic sciatica.

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Conflict of Interest

There is no conflict of interest among the authors.

References

1.Fairag M, Kurdi R Alkathiry A, Alghamdi N, Alshehri R, Alturkistany FO, Almutairi A, Mansory M, Alhamed M, Alzahrani A, Alhazmi A. Risk Factors, Prevention, and Primary and Secondary Management of Sciatica: An Updated Overview. Cureus. 2022 Nov 12;14(11):e31405. doi: 10.7759/cureus.31405. PMID: 36514653; PMCID: PMC9743914.

2. Euro U, Heliövaara M, Shiri R, Knekt P, Rissanen H, Aromaa A, Karppinen J. Work-related risk factors for sciatica leading to hospitalization. Sci Rep. 2019 Apr 25;9(1):6562. doi: 10.1038/s41598-019-42597-w. PMID: 31024023; PMCID: PMC6484005.
3. Lee K, Kim ES, Jung B, Park SW, Ha IH. Association between pain and gait instability in patients with lumbar disc herniation. J Int Med Res. 2021 Aug;49(8):3000605211039386.
4. Bonab M, Colak TK, Toktas ZO, Konya D. Assessment of Spatiotemporal Gait Parameters in Patients with Lumbar Disc Herniation and Patients with Chronic Mechanical Low Back Pain. Turk Neurosurg. 2020;30(2):277-284.
5. Mann SJ, Lam JC, Singh P. McKenzie Back Exercises. [Updated 2022 Jul 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539720/
6. ArbnoreIbrahimaj, SamireDeliu, SylejmanMiftari. Effectiveness of the mckenzie method in the treatment of low back pain in subacute and chronic stage. Research in Physical Education, Sport and Health 2015, Vol. 4, No. 1, pp.79-86.
7. Busanich BM, Verscheure SD. Does McKenzie therapy improve outcomes for back pain? J Athl Train. 2006 Jan-Mar;41(1):117-9.
8. Shipton, E.A. Physical Therapy Approaches in the Treatment of Low Back Pain. Pain Ther 7, 127–137 (2018).
9. Angela Dunsford and Saravana Kumar and Sara Clarke. Integrating evidence into practice: use of McKenzie-based treatment for mechanical low back pain. Journal of Multidisciplinary Healthcare. 2011,Vol-4,393-40212
10. Olawale O A, Agudzeamegah C M. The efficacy of interferential therapy and exercise therapy in the treatment of low back pain. Niger J ExpClinBiosci 2014;2:10-4
11. The efficacy of interferential therapy and exercise therapy in the treatment of low back pain OA Olawale, CM Agudzeamegah, Nigerian Journal of Experimental and Clinical Biosciences, Year: 2014, Volume: 2, Issue: 1, Page:10-14
12. https://www.indiamart.com/proddetail/interferential-electrotherapy-comp-ift-physiotherapy-bionics-12547067630.html (Accessed on 04/01/23)
13. Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. Spine (Phila Pa 1976). 2004 Dec 1;29(23):2593-602.
14. Sousa Filho LF, Barbosa Santos MM, Matos Vasconcelos DB, Soares EA, Dos Santos GHF, da Silva Júnior WM. Neurodynamic exercises provide no additional benefit to extension-oriented exercises in people with chronic low back-related leg pain and a directional preference: A randomized clinical trial. J BodywMovTher. 2022 Apr;30:140-147.
15. Tacu C, Rezuş E, Boiculese LV, Stratulat IS, Miu SN. Differentiation of patients with chronic lombosciatica due to disc hernia using gait analysis techniques. Rev Med ChirSoc Med Nat Iasi. 2010 Jul-Sep;114(3):694-9. PMID: 21235116.
16. Wheeler AH. Diagnosis and management of low back pain and sciatica. Am Fam Physician. 1995 Oct;52(5):1333-41, 1347-8. PMID: 7572557.
17. Albert HB, Hauge E, Manniche C. Centralization in patients with sciatica: are pain responses to repeated movement and positioning associated with outcome or types of disc lesions? Eur Spine J. 2012 Apr;21(4):630-6.
18. Cherkin DC, Deyo RA, Battié M, Street J, Barlow W. A comparison of physical therapy, chiropractic manipulation, and provision of an educational booklet for the treatment of patients with low back pain. N Engl J Med. 1998 Oct 8;339(15):1021-9.
19. Gordon R, Bloxham S. A Systematic Review of the Effects of Exercise and Physical Activity on Non-Specific Chronic Low Back Pain. Healthcare (Basel). 2016 Apr 25;4(2):22.

20. Alhakami AM, Davis S, Qasheesh M, Shaphe A, Chahal A. Effects of McKenzie and stabilization exercises in reducing pain intensity and functional disability in individuals with nonspecific chronic low back pain: a systematic review. J PhysTher Sci. 2019 Jul;31(7):590-597. doi: 10.1589/jpts.31.590. Epub 2019 Jul 9. PMID: 31417227; PMCID: PMC6642883.
21. Olawale O A, Agudzeamegah C M. The efficacy of interferential therapy and exercise therapy in the treatment of low back pain. Niger J ExpClinBiosci 2014;2: 10-4
22. Anshika Singh1, SumitRaghav. Effect of Interferential therapy along with McKenzie Extension Bias Exercises on Pain, Disability and Spinal Extensors Muscles Strength among the Patients with Chronic Low Back Pain. Indian Journal of Public Health Research & Development, (2020). 11(9), 155–161.

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Risk Assessment Of Work-Related Musculoskeletal Disorders Among Tailors In Vadodara City

Slesha M. Shah[1*], Rushikesh K. Joshi [2]

[1]PG Scholar, (Neurological and Psychosomatic Disorders), Krishna School of Physiotherapy & Rehabilitation, KPGU, Vadodara, Gujarat, India, [2]Associate Professor (Neurology & Psychosomatic Disdorders) College of Physiotherapy, Sumandeep Vidyapeeth Deemed To Be University, Vadodara, Gujarat, India.

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ABSTRACT

Background: Musculoskeletal disorders have become more in recent decades. Primary causes being job environment and working conditions. Musculoskeletal disorders can be defined by the impairment of bodily structures and localized blood circulation caused primarily due to work or work environment. The tailoring industry of India is an unorganized sector and majority employees are from lower economic class. Hence despite of discomfort in working due to awkward posture and repetitive stress injury they are compelled to work bearing the unfavourable circumstances.

Objectives: 1) To see the prevalence of risk of work-related musculoskeletal disorders in tailors by using Cornell Musculoskeletal Discomfort Questionnaire. 2) To see the prevalence of risk of work-related musculoskeletal disorders in tailors by using REBA.

Method: A descriptive community based cross sectional study was conducted in Vadodara city, Gujarat from December 2022 to May 2023. 50 tailors were taken as subjects for the study according to inclusion and exclusion criteria from Vadodara city. Tailors were chosen by convenient and purposive sampling and were interviewed and assessed by approaching them at their work place and CMDQ and REBA scales were filled.

Results: As per statistical analysis 14% were suffering from mild discomfort, 54% were suffering from moderate discomfort, whereas 32% complained of severe discomfort.

Conclusion: A multidirectional approach including appropriate technique in terms of operators, posture and ergonomically sound workstation are required to avoid debilitating effects of musculoskeletal disorders among the workers.

Keywords: Musculoskeletal Disorders, Tailors , REBA, CMDQ.

INTRODUCTION

Musculoskeletal problems have become more widespread in recent decades all across the world. Work environment and job performance are substantial contributors for the development or worsening of physical and mental illnesses. Several work-related characteristics like prolong overstretched & awkward posture, repetitive movements, poor weight lifting techniques, psychological stressors have been identified as risk factors for WRMSDs.[1,2]

Musculoskeletal disorders can be defined by impairments of bodily structures such as muscles, joints, tendons, ligaments, nerves, bones & the localized blood circulation, caused due to primarily by work or work environment.

Corresponding author: Slesha M. Shah, PG Scholar, (Neurological and Psychosomatic Disorders), Krishna School of Physiotherapy & Rehabilitation, Kpgu, Vadodara, Gujarat, India

Email: Slesha108@Gmail.com

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Studies suggest that result in pain and functional impairment mainly affect neck, shoulder, elbow, forearm, wrist and hand due to development of work-related disorders. Work related musculoskeletal disorders leads to degenerative and inflammatory conditions mainly affecting the peripheral nerves, joints, ligaments, tendons and muscles which will lead to pain and functional impairment in later stages, mostly seen in upper extremities and neck region.[3]

Repetitive movements of hand and wrist cause peritendon inflammation and cellular proliferation, increased production of matrix components, tendon degeneration and functional losses. The chronic tendinopathies cause tendon and sheath degeneration and fibrosis in combination with inflammatory and proliferative changes. Repetitive movements lead to decrease in muscle mass and myofiber area and increase 1b non-contractile tissues.[4]

Risk factors of wrmsds are following;

Physical risk factors of work-related musculoskeletal disorders include awkward postures, forceful exertion, hand arm vibration, repetitive movements, mechanical compression.

Psychological risk factors of work-related musculoskeletal disorders include work pace, anatomy, monotony, work or rest cycle, social support from other colleagues of task demands.

Individual risk factors of wrmsds includes age, gender, sports activity, recreational activities, alcohol or tobacco consumption, previous work-related musculoskeletal disorders.[5]

Tailoring involves monotonous, highly repetitive tasks like cutting, assembly, pressing and finishing, performed in a sitting working posture with upper back curved and head bent, raising their elbows above/below the shoulders, bend their wrist downward and inward and bend their back forward over the sewing machine.[6,3]Constant awkward posture may develops imbalances in muscles which may create shortening and tightness of muscle[7] which leads to postural discomfort that increases with years of employment.

The tailoring industry of india is an unorganized sector, mostly run by private establishments. It provides employment for both men and women, majority from lower socioeconomic classes. The employees of this industry hardly ever benefit from occupational health and safety provisions. They lack any type of social security, so their ill-health and poverty go hand by hand and create a stupendous pressure from which they can hardly come out. In spite of these facts, there is dearth of published literature on this topic especially in this part of the country. Hence, the purpose of the study is to see prevalence of work-related musculoskeletal disorders among tailors in vadodara city.

LITERATURE SURVEY

- Ammne mary joseph conducted study on work, work space organization and discomfort of normal working in tailoring units. The study conducted by using 200 samples. The result showed that the women engaged in tailoring work were having low back pain, fatigue and stress. The conclusion was that if the tailoring adopts good posture so it will help to increase productivity and relieved from pain.[8]
- Narish amar etalconducted study on a frequency of work-related musculoskeletal disorders and ergonomics risk assessment among tailors. Study was done in 400 tailors. Body mapping chart was used for assessment. Results show 80% population had upper back musculoskeletal disorders. The study concluded that most tailors had a upper back musculoskeletal disorders.[9]

Adam H. Schwarts et al;conducted study on intra-rater and inter-rater reliability pf the Rapid Entire Body Assessment (REBA) tool. Eight observes were used to evaluate tasks which was performed two times in succession by the same individual. For this study secondary data analysis method was used. The results show REBA has high intra-rater reliability (ICC=0.925) for REBA.[10]

Tesfaye HambisaMekonne et al (conducted study on physical and environmental and occupational factors inducing work related neck and shoulder pain among self-employed tailors. Study was done on 419 tailors. Nordic Musculoskeletal questionnaire was used to assess risk of Musculoskeletal disorders.

The result of the study show shoulder pain (72%) and neck pain (0.83%). The study concluded that work related neck and shoulder pain which is induced by physical factors of work environment. {Ardalam Shariat et alconducted study on the banasamelayu version of CMDQ: Reliability and validity study in Malaysia.115 participants were selected in this study. Questionnaire was self-administered two times method was used. The results showed the range of kappa coefficients for the frequency, severity and interference scales respectively. The conclusion of the study was CMDQ confirmed high validity and reliability.[12]

MATERIALS AND METHODOLOGY

- **Study Site:** Vadodara City
- **Study Population:** Tailors
- **Sample Size:** 50
- **Type Of Sampling:** Convenient and purposive sampling
- **Study duration:** 6 months
- **Study design:** A cross sectional study

Inclusion Criteria

- Age group:20-45 years.
- Both males and females.
- Tailors working with machine.
- With minimum 2 years of exposure.
- Tailors willing to participate in study.

Exclusion Criteria

- History of trauma or any major illness.
- Having known condition of musculoskeletal, neuromuscular disease.

Materials used in the study:

- Consent form
- Questionnaire
- Pen

METHODOLOGY

A cross sectional study was conducted from december-2022 to may-2023 in the vadodara city. 50 Subjects of the vadodara city who were fulfilling the inclusion criteria had included in the study considering prevalence of musculoskeletal disorders. Written informed consent was obtained from all subjects before the start of the study. All the tailors were assessed regarding risk of work related musculoskeletal disorder. It was done using "rapid entire body assessment" and "cornell musculoskeletal discomfort questionnaire" was filled up by the investigator. The cmdq has 3 parts along with diagram of body regions. The first part included that during last week how often did participants experience ache, pain and discomfort. Second part included that how uncomfortable was that experience of ache, pain and discomfort. Third part dealt with that did this interfere with their ability to work. Also, the posture assessment was done by using reba (rapid entire body assessment). Collected data were compiled on microsoft excel worksheets to make graphical presentation. Ms word was also used to make tabular and detailed presentation.

RESULT

According to our study done on tailors in vadodara city, out of the 50 subjects considered for this study 28% of the subjects complained of the discomfort once every day. 26% And 18% subjects complained of the discomfort 1-2 times last week and 3-4 times last week.20% Of the subjects complained of discomfort several times a day.

As per the data obtained from this study about 88% of the subjects complained of discomfort in their lower back which became the most adversely affected region. Neck and foot were the second most complained regions for the discomfort by about 48% and 56% of the subjects respectively. Subjects complaining for discomfort in shoulder, upper arm, upper back, forearm, wrist, hip and thigh were 26%,18%,4%,46%,24%,26% and 20% respectively. Knee, lower leg and palm were also complained for discomfort frequently by 34%,48% and 18% of subjects respectively.

As per statistical analysis and derivation from the study about 50% male and 43.3% Females are at moderate risk. For further 10% males and 6.67% Females were found to be at low risk.

30% Males and 33% females are at high risk for work related musculoskeletal disorders. About 5% male and 13.35% Females are at very high

risk for work related musculoskeletal disorders. Postural and ergonomic changes are needed to be implemented for them immediately.

Table 1: Gender Distribution Among Tailors

Gender	No. Participants
Male	20
Female	30
Total	50

Age Distribution

Total no of participants	Mean Age	SD
50	48.54	2.42

Level Of Discomfort Among The Tailors

Table 2. Percentage Of Discomfort In Diff. Body Regions.

Discomfort at Body Regions	% of Discomfort in Body Regions
Neck	48%
Shoulder	26%
Upper Back	4%
Upper Arm	18%
Lower Back	88%
Fore Arm	46%
Wrist	24%
Hips/Buttocks	26%
Thigh	20%
Knee	34%
Lower Leg	48%
Foot	56%
Palm	18%

DISCUSSION

The textile industry is the largest manufacturing sector in india, accounting for around 20% of india's industrial output and 37% of its total exports. Therefore, adequate importance should be given to the welfare of the millions of workers employed in this sector, especially those working in tailoring industry, which is one of the pillars of this sector.[13]

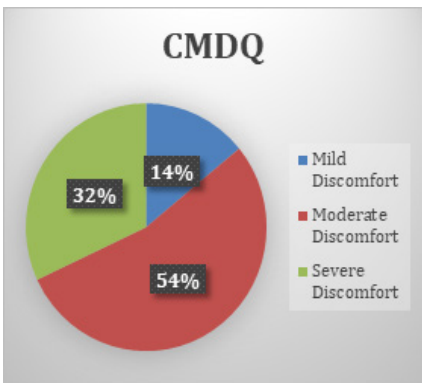
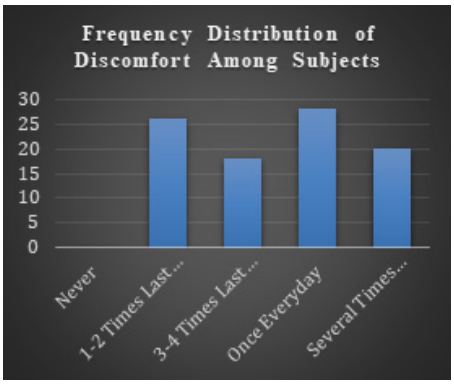
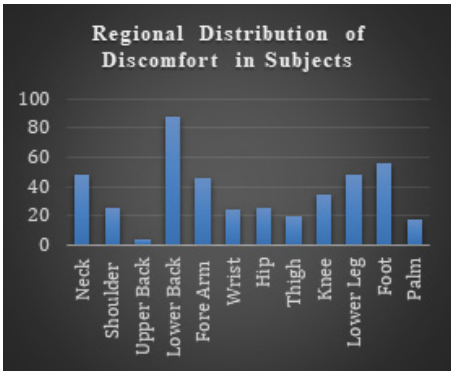


Chart 1: Severity Of Generalized Body Discomfort Among Tailors



Graph 1: Frequency of having Discomfort among tailors



Graph : Percentage of Discomfort in Diff Body Regions

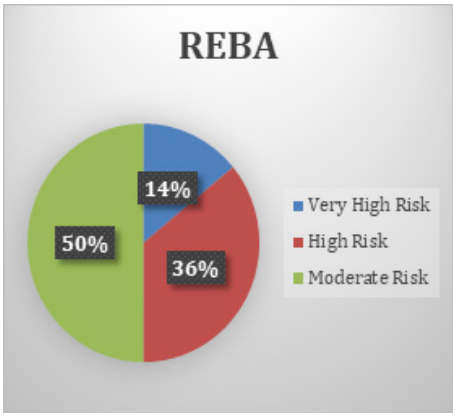


Chart 2: Percentage of Risk of Wrmsd's

Our study shows that there was more affection in lower back region (88%), followed by foot (56%), lower leg (48%), neck (48%), forearm (46%), knee (34%),

Shoulder (26%), hip (26%), wrist (24%), thigh (20%), palm (18%), upper arm (18%) and upper back (4%). The prevalence of musculoskeletal disorders among tailors was reported to be at: most common site being neck, followed by lower back, upper back and shoulder. Our study shows that female is more prone for high risk (33%) and very high risk (13.3%) Than males for high risk (30%) and very high risk (5%) of musculoskeletal disorders.[13]

Apart from age, sex and duration in the profession, musculoskeletal disorder was significantly associated with more than 8 hours work per day and it remain significant after adjusting with other variables.[1,2]Sokas et al compared sewing machine operators to a subset of the general population matched for age, race and gender and weighted toward lower socioeconomic groups and minority populations and found that sewing machine operators had a higher prevalence of self-reported upper back and upper extremity pain.[14]

Workstation ergonomics, as revealed by our study was significantly associated with musculoskeletal disorders, even when adjusted with other socio-demographic and work-related variables. The finding is similar to those of nag et al who observed that work postures and fatigue were major problems of the sewing machine operators.{20} So, there was a necessity to study wrmsds in tailors to prevent further complications and improve work station ergonomics.

CONCLUSION

Present study highlights the risk of WRMDs among the subjects engaged in tailoring occupation. This study has also taken into consideration their discomfort level in different regions of the body and ergonomically deranged work station although majority of work-related musculoskeletal disorders are of a mild intensity the initial stage and might be self-limiting in nature, however long-term awkward posture and long duration of working hours may lead to chronic, disabling, interfering persistent pain. It may lead to permanent physical disability adversely affecting work efficiency which will lead to severe morbid condition in future.

Limitation

Small sample size

Future Scope

The study should further progress in the future to establish correlation between the number of work hours and the risk associated for Wrmds.

Further study should be undertaken to see the affection of Wrmsds on activities of daily living.

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Conflicts Of Interest: None

Ethical Clearance: Approval was taken from ethical committee.

REFERENCES

1. Andersson GBJ: Epidemiologic features of chronic low back pain. Lancet 1999,354:581-5.
2. Szymanska J: Disorders of musculoskeletal system among dentists from the aspect of ergonomics and prophylaxis. Ann Agric Environ Med 2002 9:169-173.
3. Introductory chapter; work-related musculoskeletal -Orhan Korhan, Asad Ahmed Memon WRMS, 2019.
4. Ann E.Barr PT, PH D et al; "Work Related Musculoskeletal Disorders of the hand and wrist: Epidemiology, Pathophysiology and Sensory motor changes." Journal of orthopaedic and sports physical therapy. Vol 34(10),pages 610-627.
5. Nazish Anwar, Huma Riaz, Aruba Saeed, Faiza Ashraf et al, Frequency of work related musculoskeletal disorders and ergonomic risk assessments among tailors; Pak Med Assoc, Feb 2018.
6. Nazish Anwar et al , frequency of work related musculoskeletal disorders and ergonomics risk assessments among tailors : Journal pak Med Assoc.2020; 70: 2164.
7. Banerjee S. Bandyopadhyay L. Dasgupta A, work related musculoskeletal morbidity among tailors : A cross sectional study in a slum of Kolkata : Kathmandu University Med J 2016; 56(4): 305-10.
8. Ammnne Mary Joseph, workspace organization and body discomfort of low income working in tailoring units : Journal of scientific research 65(4),2021.
9. Narish Amnar et al, frequency of work related musculoskeletal disorders and ergonomics risk assessment among tailors,2020.
10. Adam H. Schwarts et al, Intra- rater and Inter- rater reliability of the Rapid Entire Body Assessment (REBA) tool. International journal of industrial ergonomics vol71,111-116,2019.

11. Tesfaye Hambisa Mekonnen et al, physical, environment and occupational factors including work related neck and shoulder pain among self employed tailors of informal sectors in euthopia 2019
12. Ardalam Shariat et al. The banasamelayu version of Cornell Musculoskeletal Discomfort Questionnaire (CMDQ): Reliability and validity study in Malaysia : work .2016:54(1): 171-178.
13. Jahan N, Das M, Monadal R, Paul S, Saha T, Akhtar R, Prevalence of musculoskeletal disorders among the Bangaladeshi Garments Workers. SMU medical journal. 2015; 2(1):120.
14. Sokas RK, Spiegelman D, Wegman DH self reported musculoskeletal complaints among garment workers. Am J Ind Med. 1989; 15(2): 197-206.
15. Nag A. Desai H, Nag PK. Work stress of women in sewing machine operation. J Hum Ergol (Tokyo).1992 Jun; 21(1):47-55.
16. Nazish Anwar, Huma Riaz, Aruba Saeed, Faiza Ashraf et. Al, Frequency of work related musculoskeletal disorders and ergonomic risk assessments among tailors; Pak Med Assoc, Feb 2018.
17. Bandyopadhyay L. Musculoskeletal and other health problems in Workers of Small Scale Garment Industry – An experience from an Urban Slum , Kolkata. ISRO J Dent Med Sci.2012; 2(6): 23-8.
18. Saha TK, Dasgupta A, Butt A, Chattopadhyay O. Health status of Workers Engaged in the small Scale Garment Industry: How healthy are they? Indian J Community Med Off Publ Indian Assoc Prev Soc Med. 2010 Jan; 35(1):179-82.

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