Application of the Occupational Therapy Practice Framework and Evidence-based Practice in a Clinical Situation

Joseph K. Wells

BOT (India), OTD (USA), OTR/L (USA) AmeriCare Health Services, LLC, USA

Abstract

Occupational Therapy has a unique focus on human functioning and views human function not merely as a physiological/ physically observable occurrence. It also acknowledges function as the resultant of interactions of several internal factors present within the person, and external factors such as the environment and socio-cultural constructs. In 2002, the American Occupational Therapy Association published a document called the Occupational Therapy Practice Framework: Domain and Process. It detailed the profession's unique focus on human occupation as it relates to all activities of daily living and its core values, beliefs and processes to facilitate optimal human occupation. This article explores the applicability of the Occupational Therapy Practice Framework and principles of evidence-based practice in a clinical scenario. Although, the article is based against the backdrop of the United States healthcare system (only as applied to insurance policies and payment for services), one may easily generalize the applicability of the Occupational Therapy Practice Framework, and evidenced-based principles in their practice globally.

Keywords

Occupational Therapy, Practice Framework, Evidence-based Practice

The Clinical Scenario

The client is a white, 67-year-old female, who suffered an ischemic cerebro-vascular accident (CVA) due to left middle cerebral artery blockage. Medical history was significant for diabetes and hypertension. She was admitted to the swing bed facility from the hospital with a request for occupational therapy consult from her physician.

The Domain and Process of Occupational Therapy Applied to My Client

The practice of occupational therapy is guided by core concepts and constructs. These constitute the 'domain' of the profession. American Occupational Therapy Association (AOTA) states, "The domain frames the arena in which occupational therapy evaluations and interventions occur" (2002, pp. 609- 610) [1]. The occupational therapy service delivery process includes evaluation, intervention and outcomes.

As discussed below, we applied the Occupational Therapy Practice Framework: Domain and Process (AOTA, 2002)[1] to the clinical scenario through the various stages of the service delivery process. We will refer to this document as the 'Framework' for future discussions.

The Evaluation

The process begins with the evaluation of needs, problems, and concerns. It is aimed at generating an occupational profile based upon the client's history, experiences, patterns of daily living, interests, values and needs and, the inability/ difficulties to perform in appropriate occupational roles as desired and/or applicable to the client as identified via an analysis of occupational performance. The analysis looks at factors effecting occupational functioning (AOTA, 2002). [1]

On the day of admission to the swing-bed facility, the client was first seen in her room for an occupational therapy initial evaluation. The evaluation focused on developing an occupational profile of the client, analyzed her ability to function in her occupational role based upon the stage of her life span (age) and socio-cultural construct (gender, familial, societal roles) at baseline, and identified her needs, problems and priorities for intervention as defined by the scope of the profession (AOTA, 2004) [2]. The

Reprint requests : Joseph K. Wells
President, AmeriCare Health Services, LLC
1132 E. Second Street, Defiance, OH 43512.
Fax: (419) 782 0105.
E-Mail: joewells@americare-health.com

initial evaluation was coded as 97003 per the common procedural terminology (CPT™) codes (American Medical Association [AMA], 2004)[3]. CPT codes are used to depict interventions / procedures by healthcare providers. These are coded numerically (example: 97003 for OT initial evaluation) or may have numbers in association with letters (example: G0283 for manual electrical stimulation). CPT codes are used specifically to bill certain insurance companies including the United States government run policy commonly called Medicare.

Re-evaluations were technically carried-out with each subsequent visit in order to monitor progress and response to the intervention / s, and to determine the need for future modifications and interventions in the intervention / s.

The evaluation tools I used included a general formatted assessment geared toward clients with adult- neurological conditions, and the Canadian Occupational Performance Measure (COPM) scale. The COPM is based on the definition of occupational performance as given in Enabling Occupation: an Occupational Therapy Perspective (Canadian Association of Occupational Therapists [CAOT], 1997)[4]. The initial evaluation for adult- neurological conditions comprised several standardized and non-standardized tests mainly based on the Uniform Terminology 3rd edition (UT III) format (AOTA, 1994)[5] and reflective of the HCFA-700 form recommended by the Center for Medicare and Medicaid Services for evaluations by physical and occupational therapists. This evaluation tool documented client demographics, prior level of functioning, reason for referral to occupational therapy, significant medical history, client's living condition and support system, client's functional abilities in terms of ability to perform basic activities daily living (BADL) and instrumental activities of daily living (IADL) customary to client, the client's performance skills involving strength, range of motion, coordination, balance, endurance / activity tolerance, sensory functions, muscle tone and, social interactions and cognition. This evaluation based on UT III as one whole tool, has not been tested for reliability or validity but components comprising of individual tests such as the grip strength / dynamometer test, pinch test and, the Berg Balance Test (BBT), have been individually tested and verified. A study by Mathiowetz, Weber, Volland and Kashman (1984) [6] demonstrated adequate reliability and validity of grip and pinch strength evaluations. Studies by Bogle Thorbahn and Newton (1996) [7]; Riddle & Stratford (1999) [8]; and Shumway-Cook, Baldwin , Plissar and Gueber (1997)[9] have found the BBT to be a valid test to determine risk for falls.

While the initial assessment based on UT III discussed above was more a tool of observance by the evaluating therapist on how the client was performing, I chose the COPM to rate the client's self- perceived baseline status and future changes in occupational performance and satisfaction on her status. The assessment based on UT III provides clinicians the basis to understand the relationships between the person's development structure and the occupational form in which the person finds himself or herself (Nelson & Jepson-Thomas, 2003, p. 100) [10]. This assessment involves items that often apply population-based standards in performance such as grip strength by a hand dynamometer or a 9-hole peg test for hand dexterity. In contrast, the COPM describes occupational performance as an individual subjective experience. The COPM has exhibited a test-retest reliability of >0.80 via three studies (Cup, Scholte op Reimer, Thijssen and van Kuyk-Minis, 2003; Pan, Chung, and Hsin-Hwei, 2003; and Sewell and Singh, 2001) [11,12,13] . Studies by Chan and Lee, 1997;[14] Chen, Roger, and Polatajko, 2002;[15] and Simmons, Crepeau, and White, 2000,[16] with samples similar to my client verify the validity of the COPM. The COPM was found to positively correlate for content, criterion and construct with the Functional Independence Measure (FIM ™), Life Satisfaction Scale (LSS), the Satisfaction with Performance Scaled Questionnaire (SPSQ) and the Reintegration to Normal Living Scale (RNL). Utility of the COPM as it relates to responsiveness to change, ease of administration, time to completion, and ability to communicate aspects of occupation were found to be significant across various clinical settings, populations, and also in different languages and cultures (Chen et al. 2002;[15] Pan et al. 2003;[12] Simmons et al. 2000;[16] and Wressle, Marcusson, and Henricksson, 2002).[17]

I also chose the FIM ™ as an extension of my assessment and as an outcome tool and thus, incorporated results from my initial evaluation using data produced by both assessment tools into the FIM ™ scale. The scale originally developed by the American Congress of Rehabilitation Medicine and the American Academy of Physical Medicine and Rehabilitation and, supported by 11 national professional organizations was found to have adequate reliability, validity, and responsiveness (Deutsch, Fiedler, Iwanenko, Granger and Russell, 2003)[18]. Intra-class correlation coefficient was found to be 0.96 - 0.99 for motor components on the FIM ™ scale, and 0.91- 0.97 for the cognitive components of the FIM ™ scale (Hamilton, Laughlin, Fiedler and Granger, 1994) [19]. Assessing concurrent validity, Deutsch et al. (2003) [18] also found a strong relationship between FIM ™ scores and scores on the Barthel Index, a functional assessment tool that was commonly used in rehabilitation facilities in the United States before the development of the FIM ™ instrument. The predictive validity of FIM ™ scores has also been shown using various dependent variables, including minutes of assistance needed by the person who is disabled, discharge functional status, length of rehabilitation stay, and likelihood of discharge to the community. (p. 705).

Occupational Performance Deficits

Using the Framework the client's ability to engage in occupation to support participation in context/s was evaluated as discussed below.

Performance in areas of occupation. As a part of the evaluation, during the process of formulating an occupational profile, the client was asked about her prior level of functioning, home environment, caregiver/support systems and her interests/ leisure. This was helpful to gain an insight to the extent of dysfunction/ morbidity caused by her current condition beyond just physiological implications of the disease/ condition.

The client's ability to perform BADL and IADL tasks including interests and participation in leisure and social activities were evaluated. The client stated that prior to her stroke she had played cards with a small group of ladies that met twice a week at her apartment complex and went to the local church to attend mass every Sunday morning. Since the client was a retiree, play and work as identified in the Framework, were not directly applicable in this case. The client did not participate in any organized volunteer tasks and did not state any future interests in the same. Information on educational level and previous employment were sought for demographic purposes and to gain an insight on the client's possible aptitudes and interests in life, including reading and leisure habits.

The client's initial status in areas of occupation as related to the clients functioning in BADL and IADL tasks and, the clients self-rating per the COPM has been summarized in Table 1.

Table 1. Client Status in Areas of Occupation During Initial Evaluation

Areas of Occupation (BADL and IADL)	Functional Status
Self-feeding	Needed set-up assistance (S/U)
Grooming	Minimally Assisted (Min A)
Upper body bathing	Minimally Assisted (Min A)
Upper body dressing	Minimally Assisted (Min A)
Lower body bathing	Moderately Assisted (Mod A)
Lower body dressing	Moderately Assisted (Mod A)
Toileting	Moderately Assisted (Mod A)
Household I-ADL/ Social activities/ Leisure	Maximally Assisted (Max A)
COPM- Client rating: Combined average score: 3.0 for performance; 3.5 for satisfaction with status (out of a maximum score of 10 per item)	

As identified in the Framework, occupational performance, that is, the ability to engage in areas of true occupations is not an independent factor but rather a synthesis/ outcome of other continually interacting aspects such as performance skills, performance patterns, context, activity demands and client factors (AOTA, 2002) [1]. Kindly refer to figure-1 for a schematic representation of the various interdependent factors relating to occupational performance and the service delivery model as highlighted by the Framework (AOTA, 2002) [1] .The various factors as applicable to my client are discussed below.

Performance skills. The client was tested for motor, processing and communication/

interaction skills. The client demonstrated minimal hypertonicity of the right upper extremity distally and hypotonicity of the right lower extremity, and lack of gross and fine motor coordination. Postural instability was caused due to the client's inability to bear weight adequately through her right side and thus, her mobility and ability to participate in ADL was affected. The client's voluntary control for the right upper extremity was grossly poor+ on a descriptive scale parallel to late stage 2 of the six recovery stages of the arm, with synergic patterns of movement (Brunnstorm, 1970) [20]. The client needed moderate assistance with mobility needs such as getting in / out of the bed, functional transfers, etc. The client fatigued easily and performed all functions in a considerably slow pace taking frequent rest breaks due to decreased endurance and strength. Motor praxis was intact.

Overall, process skills involving task initiation, attention to tasks, and modification of actions during task execution, temporal and spatial organization were fairly intact. The client demonstrated minimal perceptual deficits and needed minimal cues to compensate / adapt for right-sided neglect. Cognitive skills for orientation, short term and long-term memory, sequencing and following instructions were fairly intact. The client showed good knowledge and ability to follow-through learnt tasks.

Communication / interaction skills were minimally affected due to expressive aphasia with occasional substitution of words or letters. The client was able to correct herself most of the times after misspeaking. Due to her low endurance level, she could only meet visitors for short periods during which she preferred sitting in a chair with a backrest. The client's social / interactive behavior and demeanor was appropriate at all times.

Performance patterns. This aspect of the domain per the Framework is important to understand the habits, routines, and roles that are central to occupational performance (AOTA, 2002) [1]. The condition / physical impairments and change in environment due to institutionalization caused a change in the client's sleep pattern. Her traditional role as a spouse with her set responsibilities was, at least temporarily, interrupted with her being institutionalized.

Context. The evaluation further studied the client's current performance and how it was impacted by factors such as her personal beliefs and values, culture, spirituality, physical and virtual environment, social obligations / status and based upon dimensions defined by time (example: the need to shower every morning after breakfast).

The client based on her culture as an American, strived for her independence versus dependence on her family. As a devoted catholic, she believed in going to the church every Sunday. Her physical and virtual environments at the facility were not like she was used to at home, and stated she missed her big- screen TV the most. She wanted to be as independent as possible, and was generally bashful to seek help from the staff. She felt that she was somewhat of a burden on her friends and family now due to her condition.

Activity demands. The client demonstrated good use of tools, materials, and items routinely used for ADL. The space demands (the client's room) at the facility was adequate although, the client realized that her apartment was larger and differently set-up. From a physical context standpoint, the bathroom in the facility was more accessible with a roll-in / walk-in shower versus a tub in the client's apartment. The social demands from a recovery standpoint may be viewed per the client's own personal and cultural values to be independent, serve in her established role as a spouse, and as a member of a church and a social group to which she belonged. These social demands were obviously unsatisfied by her institutionalization. Actions, body functions and body structures required to perform human occupations were assessed using standardized and non-standardized tests. Physiological functions such as mobility, cognition, level of consciousness, strength, processing skills, status of anatomical structures (body parts such as hands, legs, etc.) were assessed. Due to the right-sided weakness and lack of coordination, the client was unable to meet the activity demands to function independently. The client was pre-morbidly right hand dominant. Circulation, skin condition, blood pressure, blood oxygen saturation, heart

and respiratory rate were all within normal limits. Anatomical structures were intact.

Client factors. As a part of the evaluation, a brief review of organ- systems to determine body functions and structures (client factors) affecting occupational performance was done. The client demonstrated good mental functions overall, except need for minimal cues due to minimal right-sided neglect. The client also needed further education on the condition (CVA) itself. Gross / discriminatory sensations were within functional limits. Cardiovascular, hematological, immunological and respiratory functions were within normal limits as evidenced by the vital signs and lab reports. No digestive or urino-genital concerns were reported by the client or, marked on the physician's progress notes. No external abnormalities were found associating the integumetary system. Neuro-musculoskeletal and movement related functions were affected due to right-sided weakness and lack of coordination. The client also demonstrated minimal hypotonia of the right extremities. While active ranges of motion were affected due to weakness in the extremities, all passive ranges of motion were well preserved. The client was unable to take more than 2 steps while walking. Deep tendon jerks were diminished in the affected extremities and no primitive reflexes were present. The client's voluntary control was grossly at a poor^{+} level for the right upper extremity and fair^{-} for the lower extremity. The client needed moderate assistance with mobility needs such as getting in / out of the bed, functional transfers, etc. The client fatigued easily and performed all functions in a considerably slower pace taking frequent rest breaks due to decreased endurance and strength. Postural instability was noticed due to the client's inability to adequately weight bear on the right side.

The Therapeutic Intervention

After generating an occupational profile and thorough analysis of occupational performance, several deficit areas were identified as discussed above. The process of service delivery was then focused on addressing these deficit areas, within the scope of occupational therapy (OT). This phase of the process constitutes the intervention. The interventional phase involves firstly, formalizing a plan (along with outcomes desired) to guide actions based on theories, frames of references and evidence, secondly, implementing the plan and finally, reviewing the intervention to determine its effectiveness and need for changes (AOTA, 2002, p. 614).[1]

The intervention plan with our client involved setting-up occupational therapy goals and treating the client for 3 weeks with possible discharge plans to continue OT at a local skilled nursing facility. Targeted performance deficits and corresponding intervention approaches and types are discussed below.

Intervention approaches

Several approaches as identified in the Framework were used. Our intervention primarily utilized remediation and restoration techniques targeting deficits in performance (mainly motor) skills due to decreased right-sided strength, postural imbalance, minimal right-sided neglect and right-sided lack of coordination. The approach targeted skills required to restore prior roles and functions performed by the client. The client was also encouraged to attend recreational activities to improve interaction / communication skills, in addition to group OT treatments. Client factors such as strength, voluntary control / coordination, and postural balance and, mobility (neuromusculoskeletal and movement related functions) were targeted via remediation / restoration techniques to obtain normal function per prior level of functioning.

Another intervention approach also sought to modify the physical context in the facility via compensatory strategies to facilitate independence (example: bed rails to assist with bed mobility, standard walker and manual wheelchair to assist with transfers and mobility needs respectively), and / or via adaptations to simulate similarities to the client's actual context / s (example: a non-functional tub for tub transfer training with the use of a extended tub bench). These modifications / compensatory strategies were aimed at meeting activity demands via use of adaptive / supportive equipments. The client's performance patterns were also modified. Although, all attempts to maintain the client's actual routines were made, changes in routines and deviations from habitual ways of functioning

were inevitable due to the physical manifestations of the condition and changes in physical context due to institutionalization. The client's socialization habits were compromised and, were modified within the confines of the facility and so were her spiritual obligations. She was invited to go to mass in the facility's chapel on Sundays.

The intervention approaches also involved prevention of disabilities, maladaptive patterns and functions, abnormal tone / structural deformities via ensuring optimal postural balance, bed and seating positioning, preventing unsafe fatigue, and preventing risk for injury with proper transferring and lifting techniques as applicable. Positioning of extremities in bed where achieved with use of pillows or towel rolls. Appropriate positioning on wheelchair was achieved with a transparent half-lap tray on the right and foot rests. As passive ranges of motion (PROM) were well preserved on the affected side, we did not apply any hand / wrist splints at this stage. Ma and Trombly (2002) [21] via a meta-analysis of 36 studies (29 were finally included) suggested that splinting might be an ineffective approach used by occupational therapists to treat spasticity in persons with stroke. However, as also recommended by them, definitive studies to verify their findings are still needed. We founded our clinical approach mainly based on the fact that PROM was normal, and the tone was minimally hypertonic.

To a lesser degree our approaches also involved maintenance techniques. This involved ensuring that strength of the unaffected side (left) was optimal and the client's performance patterns / routines were followed as much as possible.

A health promotion approach via client education on healthy lifestyle was also incorporated in the treatment plan to help the client identify and prevent risk factors involving strokes

Types of Interventions

Human occupational performance is not an independent factor but rather the resultant of different aspects identified under the Domain of Occupational Therapy (AOTA, 2002) [1]. OT intervention may either be directed on task-specific (functional) practice of client-identified activities (Walker, Drummond & Lincoln, 1996) [22], or, may focus on remediation / restoration of deficit areas that cause the occupational deprivation or dysfunction. Edmans, Webster and Lincoln (2000) [23] were unable to find clinical or statistical difference between transfer of training or functional training outcomes. Trombly and Ma (2002, p. 258) [24] have also suggested that perhaps, at times, strategy training is more effective than task specific training for some clients; or treatments of underlying abilities required for functional performance may be most appropriate.

The Framework categorically states, "Occupational therapists are trained to assess all aspects (of the Domain) and to apply that knowledge to an intervention process that leads to engagement in occupations to support participation in context or contexts" (AOTA, 2002, p. 611) [1]. Our intervention thus, included a variety of tools aimed at improving / restoring the client's performance in occupational areas. The types of interventions used were as follows:

Therapeutic use of self. Our (OT staff involved with the care) personal insights, perceptions and judgments along with our personal interactions were ensured to be conducive to the client's therapeutic milieu. This was also required as an active part of therapy to elicit appropriate responses along with neuro-physiological techniques (NPT), neuro-developmental techniques (NDT) and proprioceptive neuromuscular facilitation (PNF) techniques.

Preparatory methods

Our interventions included several techniques aimed at remediation / restoration of performance skills in preparation for purposeful and occupation-based activities (Pedretti & Early, 2001) [25]. This included NPT, NDT and PNF techniques to facilitate voluntary control, tone regulation in the affected extremities of the right side; and use of physical agent modalities (ice, water, heat, electrical stimulation, etc. as a part of NPT and NDT techniques). We also used exercises / movement therapy based upon Brunnstrom's principles (Brunnstrom, 1970; Pedretti, 1990) [20, 26]. In conjunction to Brunnstorm's principles, we used modified constraint induced movement (m-CIM) therapy. We chose a m-CIM technique as it would have

been difficult to implement a complete Constraint Induced Movement (CIM) therapy due to client and staff compliance issues as well as due to the operational policies at our swing-bed facility pertaining to physical restraints. We restrained the non-affected (left) upper-extremity with a hemi-sling and a padded hand-mitt, and thus, forced use of the affected upper limb. This was done no more than an hour each day under direct supervision of a treating therapist and 3-4 hours every morning under nursing supervision. Dromerick, Edwards and Hahn (2000) [27] have demonstrated via a pilot study on 23 subjects (mean age= 66.4 years) that use of CIM therapy during acute rehabilitation helps reduce arm impairments after ischemic stroke. This study provided evidence via a single-blinded, randomized control trial (RCT), a level 1b study based on the Oxford Center for Evidence-based Medicine Levels of Evidence (Phillips et al., 2001) [28]. Subjects of this study in the experimental (CIM) group wore padded mittens on their unaffected hand preventing its use for at least 6 hours per day during their 14-day treatment period.

Other studies were also referenced. A case-study by Page, Sisto and Levine (2002) [29] specifically studied the effect of m-CIM in a 67-year old, white, left handed man who demonstrated left hemiparesis after sustaining a right occipital infarct approximately two years and four months prior to the study. The subject received m-CIM therapy over a period of 10 weeks. The study revealed that even in the chronic stages, the use of m-CIM provided beneficial results as evidenced by improvements on the Fugl-Meyer Assessment of Motor Recovery, Action Research Arm test, Amount of Use (of affected arm) Scale and Motor Activity Log. Although ranking low (a level 4 study) based upon the hierarchy of evidence suggested by Phillips et al. (2001) [28]. This study was highly relevant to my case because of the same age of the subject in the study and similar fashion of modification of the CIM therapy as in my case (approximately 5 hours of application per day, the same duration as of my client).

Another study of significance was one conducted by Studenski et al. (2005)[30]. This was a prospective, single-blinded RCT, a level 1 b study based upon the hierarchy of evidence suggested by Phillips, et al. (2001) [28]. Studenski et al. (2005) [30] studied the use of therapeutic exercises in subacute stroke survivors (mean age= 70 years) and concluded that rehabilitation exercises caused quicker improvements in physical, social, and role functions than usual care in persons with subacute stroke.

Dromerick et al. (2000) [27]; Page et.al. (2002)[29]; and, Studenski et al. (2005) [30], thus, provide relevant evidence supporting the use of CIM therapy or a modified version of the technique at different stages and time lapse after a stroke.

We also believe that preparatory techniques (as used in our case) for remediation of neuromusculoskeletal body functions are associated and interdependent, and a combination of techniques (example- Rood's technique along with PNF, electrical stimulation of postural muscles with weight-bearing NDT) is usually practiced versus the use of an isolated technique since the underlying physiological impact by these techniques are ideologically similar. The interventional procedures and their corresponding CPT ™ codes used for the preparatory methods were therapeutic exercises (97110), neuromuscular re-education (97112), manual electrical stimulation (G0283) and, manual therapy (97140) (AMA, 2004) [3].

Purposeful activities. These activities generally address a sub-goal or midpoint goal toward engagement in actual occupations. We used activities / tasks to improve on performance components such as sitting and standing balance, activity tolerance, functional transfers, proper use of body mechanics, use of adaptive / supportive devices and other modifications made to the therapeutically designed context / s. The procedures / CPT ™ codes used for the purposeful activities were therapeutic activities (97530) and group therapy (97150) when tasks were completed in a group of two or more clients (AMA, 2004) [3].

Occupation based activities

True occupations were incorporated both as short-term and long-term goals to facilitate the client's independence in her occupational role / s. This involved practicing of actual occupations such as grooming tasks involving brushing teeth, combing and dressing / bathing upper body in the earlier stages, to lower body dressing and

bathing, toileting and light IADL such as meal preparation, household tasks, money management, etc. as the client progressed. Group activities were used to improve social interactions and involvement in leisure tasks. The client participated in several occupation-based therapeutic tasks some more personal such as BADL, to social tasks (as components of IADL) such as planning and organizing a "mostly decaffeinated" group over a "coffee and a TV" activity or, a card game with other clients of the facility. The client, as we found, was particularly fond of television soaps and the "E!" channel. We would, at times, also incorporate post-telecast quizzes addressing her communication / interaction skills complementing the other social occupational tasks performed by the client.

The procedures / CPT ™ codes used for the intervention with occupation-based activities were self-care management training (97535), community reintegration training (97537) and group therapy (97150) when tasks were completed in a group of 2 or more clients (AMA, 2004) [3].

Occupation-based activities must address the environmental context and must be meaningful to the client. Our interventions adhered to the principles laid in the Framework as we used occupations as our goals (the "end") and also as therapeutic media ("means") by incorporating occupation-based activities as a part of our intervention (AOTA, 2002) [1]. The end / goal was to enable to client perform BADL and IADL tasks per her prior level of functioning.

To seek the evidence on occupation-based activities on occupational performance, we searched the Internet databases of Medline, Cochrane, Cumulative Index to Nursing & Allied Health Literature (CINAHL) and ACP Journal Club. We used the keywords Occupation-based activities, Therapy, Occupation Centered Practice, ADL and Outcomes. Several studies that included occupation-based approaches such as task-specific practices of true occupations incorporated along with other occupational therapy modalities were found. However, we were unable to find any study that specifically discussed the effectiveness of occupation-based activities as the only (or isolated) tool of therapy for stroke survivors. As stated in the study performed by Trombly and Ma (2002) [24] on restoration of roles, tasks and activities after stroke, we, too, were unable to find studies that specifically manipulated context or addressed and studied habit formations (essential components of occupation-based practices) as specific therapeutic interventions for stroke survivors. We speculate that the lack of directed research on occupation-based activities as the sole therapeutic agent (intervention type) for stroke survivors is also because occupational therapists often use it in conjunction with other types of interventions such as neurodevelopmental therapy, movement therapy, orthotic management based on biomechanical principles, etc., versus just as an isolated tool.

A meta-analysis (level-1a study based upon the hierarchy of evidence suggested by Phillips et al. 2001) [28] by Walker et al. (2004) [31] studied 8 single-blinded randomized controlled trials (RCTs) incorporating 1143 patients. The meta-analysis involved 655 patients that received community OT (481 ADL therapy, 174 leisure therapy) and the remaining 488 received routine care. The study indicated that patients receiving community OT that emphasized on ADL had higher scores on the Nothingham Extended ADL (NEADL) scale and the Personal ADL (PADL) scale but not on the Nottingham Leisure Questionnaire (NLQ). Those that received leisure-based OT demonstrated a higher NLQ score but not NEADL or PADL. Hence, the study demonstrated that targeted interventions caused better-targeted outcomes.

Another meta-analysis of 15 studies including some RCTs (a level 2a study based upon the hierarchy of evidence suggested by Phillips, et. al. 2001) conducted by Trombly and Ma (2002) [24] on the restoration of roles, tasks and activities synthesized research findings involving 895 participants (mean age= 70.3 years). Trombly and Ma (2002) [24] state that out of the 15 studies, 11 (7 randomized controlled trials) found that "role participation and instrumental and basic activities of daily living performance improved significantly more with training than with the control conditions" (p.250). However, the two researchers also acknowledged that empirical

research was needed to verify these findings and to characterize the key therapeutic mechanisms associated with desired outcomes. In their research article, they also recommend therapists to use structured instructions, client-identified activities, and appropriate adaptations to enable performance. They also suggest that therapists should ask clients to practice within a familiar context, and for therapists to provide feedback to clients to improve performance.

In addition to the discussed types of OT interventions, the process of consultation was followed to collaborate with the client to identify problems and problem solve as appropriate with client and her family's participation. Imparting information to the client and her family in reference to resources available, handouts pertaining to the condition, also followed the educational process.

Outcomes

The focus on outcome begins with the evaluation phase when targeted outcomes are identified and undergoes adjustments/ modifications throughout the interventional phase. The outcome of the occupational therapy process is directed toward "engagement in occupation to support participation" (AOTA, 2002, p. 618) [1]. We chose several methods to target, monitor and track outcomes in order to test the effectiveness of the OT intervention. The outcome tools we chose were traditional discharge assessment for comparison between baseline status and client's progress toward set goals, the COPM, and the FIM ™ scale.

The FIM ™ scale was applied to track outcomes relating mainly to occupational performance and to a lesser degree may also be seen as an indicator of overall health and wellness, and role competence. The average score for our client on the18-item FIM ™ scale was at a 3.0 (that is, the client needed moderate assistance, collectively, with all occupational performance areas) at the start of care. On the date of discharge, the client scored an average of 4.0 per test item demonstrating increased independence and now requiring only minimum assistance with BADL and IADL tasks identified on the FIM ™ scale.

The OT discharge assessment also served as an outcome tool to compare the client's progress toward all set goals (that were tailored directly toward the client's needs) as identified during the evaluation process. The client had shown progress toward set goals and was grossly at a minimal assistance level for all BADL and IADL. Driving was not attempted as was not identified as a target outcome at this stage. Complementing this 'therapist- measured' outcome tool, the COPM was used to detect the client's self-perception on changes in occupational performance. At discharge, her self-rated COPM scores for occupational performance problems (as identified during the initial evaluation) were 6.0 for performance and 7.0 for satisfaction. The client demonstrated an improvement on the COPM with an average score of 3 and 3.5 in performance and satisfaction respectively as compared to the initial rating. Based upon her current condition needing ongoing occupational and physical therapy intervention, the client was discharged to a skilled nursing facility on day 21 of her stay at the swing-bed facility. The outcome documented for our client was thus, achieved in 20 days.

Discussion

On the Use of Evidence-Based Practice (EBP) Benefits to skilled health care can no longer be based on subjective feelings of its worth. Services provided should be scientifically based, compliment your expertise (that is your skilled art), and be of value to your client. EBP is just that. It may be simply defined as "integrating individual clinical expertise and the best external evidence" (Sackett, Rosenberg, Gray, Haynes and Richardson, 1996) [32]. It is a process to ethically, conscientiously and discriminatively apply the best research- based evidence to decisions regarding client care (Lloyd- Smith, 1997) [33]. Studies in the past have shown that OT practitioners engage in modest amount of EBP (Dysart and Tomlin, 2002) [34]. This may be due to several factors including the paucity of research in occupational therapy particularly related to specific interventions, difficulty to access applicable research and, overall under-subscription to the EBP movement by practitioners (Alsop, 1997; Brown and Rodger, 1999; Lloyd- Smith, 1997) [35,36,33]. Clients have a right to proven, effective and efficient services.

The medical community in general, and several insurance programs including Medicare and Medicaid are increasingly subscribing to EBP. Many insurance companies are now planning and a few have begun basing payments and incentives to healthcare practitioners based on EBP as well. OT practitioners owing it to their social responsibility and for reimbursement purposes as well will have to deliver care that is evidenced-based. The centennial vision of AOTA rightly encompasses this focus to envision occupational therapy as a powerful, widely-recognized, science-driven, and evidence-based profession with a globally connected and diverse work force that meets society's occupational needs (AOTA, 2006)[37].

On the Use of the Framework in Service Delivery

Strengths of the Framework. The Framework (AOTA, 2002)[1] is an excellent bridge between the various theories, frames of references and practices in Occupational Therapy and is easily applicable in both traditional and non-traditional settings.

It provides the OT community with all its diversity in practice methods and settings, a commonality based upon core beliefs and processes that binds us together as a profession. It can be used as an effective tool to guide our practice as well as to educate external audiences about the focus and scope of occupational therapy. Modifications based on the target audience may be required.

The Framework helps with clearly identifying the domain of the profession, with its emphasis on occupation and daily life activities and the application of an intervention process that facilitates engagement in occupation to support participation in life (AOTA, 2002, p. 609)[1].

The Framework supports the client-centered model fostering a collaborative process between the practitioners and clients throughout the process of service delivery. It especially highlights the relationship of the context to the client's performance and process of delivering services (AOTA, 2002, p. 614)[1]. The context is an often-missed aspect of our domain especially in the medical model where the emphasis is primarily on remediation/ restoration of impairments/ pathological features. It is the focus on 'context/s' that drives the true essence of human performance from merely being a result of internal client factors such as body functions and structures to rather the synthesis of both internal mechanisms and external aspects (reasons, needs) of functioning.

The Framework clearly exemplifies OT's holistic approach to human functioning and complements the profession's wide scope of practice (AOTA, 2004)[2]. It is applicable in traditional setting such as hospitals, nursing homes and clinics, as well as in non-traditional settings such as day-care centers, sheltered workshops, driver education programs, etc. Also, the intervention approaches mentioned in the Framework, clearly positions the OT practitioners to function in a pan-health mode including in areas such as, health promotion and disability prevention versus intervening in customary roles only after a pathological condition/ dysfunction has occurred.

The Framework has skillfully assimilated the areas identified in the UT III (AOTA, 1994)[5] to reflect the growth of the profession in non-traditional settings as well. It also articulates OT's focus on addressing the virtual environment, thus adopting a pro-technology focus that is in keeping with the futuristic view of an ever changing, technologically savvy world. The Framework is thus timely and sensitive to the world healthcare trends. As identified by AOTA (2002)[1], the domain of OT complements the World Health Organization's (WHO) conceptualization of participation and health articulated in the International Classification of Functioning, Disability and Health (ICF) (WHO, 2001)[38]. The ICF is intended to become an operational method to classify health conditions globally. This provides the OT community not only a common language for professional interaction with other health care professionals across the world but also showcases OT's holistic approach to health and wellness. The Framework certainly has the potential to be a precursor to the profession's future growth and expansion.

Weaknesses of the Framework. The Framework is relatively new and needs to be further assimilated into the academic curricula.

Practitioners need to be trained in the understanding and use of the Framework. AOTA must continue marketing the Framework to ensure that all practitioners are knowledgeable about the document. AOTA and the OT community in general, must also be able to communicate the domain and scope of OT based on the Framework to all external audiences and gain acceptance for the same. The major drawback currently facing its application would be from the fact that in the medical model, almost all insurance programs including Medicare and Medicaid (the US government's insurance policies) do not use the ICF model (WHO, 2001)[38] for operational or payment purposes as yet.

The Framework per its intent is comprehensive and concise. The scope of the Framework is limited to generalization of OT practice versus specificities based on practice settings. This may cause confusion and drawing of camps based upon interpretations. It fails to clearly specify the requirements for entry-level OT education and practice. Also, although both the scope of practice (AOTA, 2004)[2] and the Framework (AOTA, 2002)[1] has identified several areas within the OT process, inconsistencies of educational standards amongst OT schools and certain state practice acts prohibit certain elements of practice stated within its scope. Example: Use of physical agent modalities (a preparatory method as a type of intervention). Not all OT schools train their students adequately in the use of these modalities and the state of California categorically prohibits its use by OT practitioners unless they have documented special training in its use in addition to their basic OT/OTA education (California Board of Occupational Therapy, 2003)[39]. The same may be stated in reference to the lack of uniform standards for basic science education, although the Framework asserts that "Occupational therapists and occupational therapy assistants have knowledge of…. body functions" (AOTA, 2002, pp. 625-626).[1]

The Framework fails to explicitly emphasize its support to evidence-based principles, while the medical community in general and insurance companies/ payer sources are vastly contributing to this movement. This could be, once again, because of generality of the Framework as applied to OT practice versus being directed to any particular OT setting and other reasons as discussed under the topic "On evidence-based practice". And also, the Framework was published before AOTA's Centennial Vision (AOTA, 2006).[37] The lack of emphasis on EBP in the framework was clearly rectified in the latter document (AOTA, 2006).[37]

The Framework does not emphasize on the profession's autonomy or access to service delivery. I believe that, a profession that wishes to clarify its domain, and process, must also clarify the process of referrals or access to its service. AOTA has, however, separately and previously stated that a referral is not required in the provision of occupational therapy services (AOTA, 1994, p.1034).[40] This should be included in the Framework as a reference for the process of service delivery.

Conclusion

A client- centered approach as identified in the Framework (AOTA, 2002)[1] empowered with evidence-based practices can facilitate optimal client benefits, and demonstrates the scientific and holistic approach in OT practice.

As stated by, Abreu and Peloquin, (2004)[41] , the OT community, needs to get over the "otherisms" that divide the profession into camps- such as, the academia versus the practitioners, the shelter-workshop OT versus the hospital OT, etc. Coppolla (2005)[42] rightly states, "The heart, mind, and soul of occupational therapy come to us in many ways" (p. 479). The Framework is a commendable foundation to embrace this diversity and stand unified as one community.

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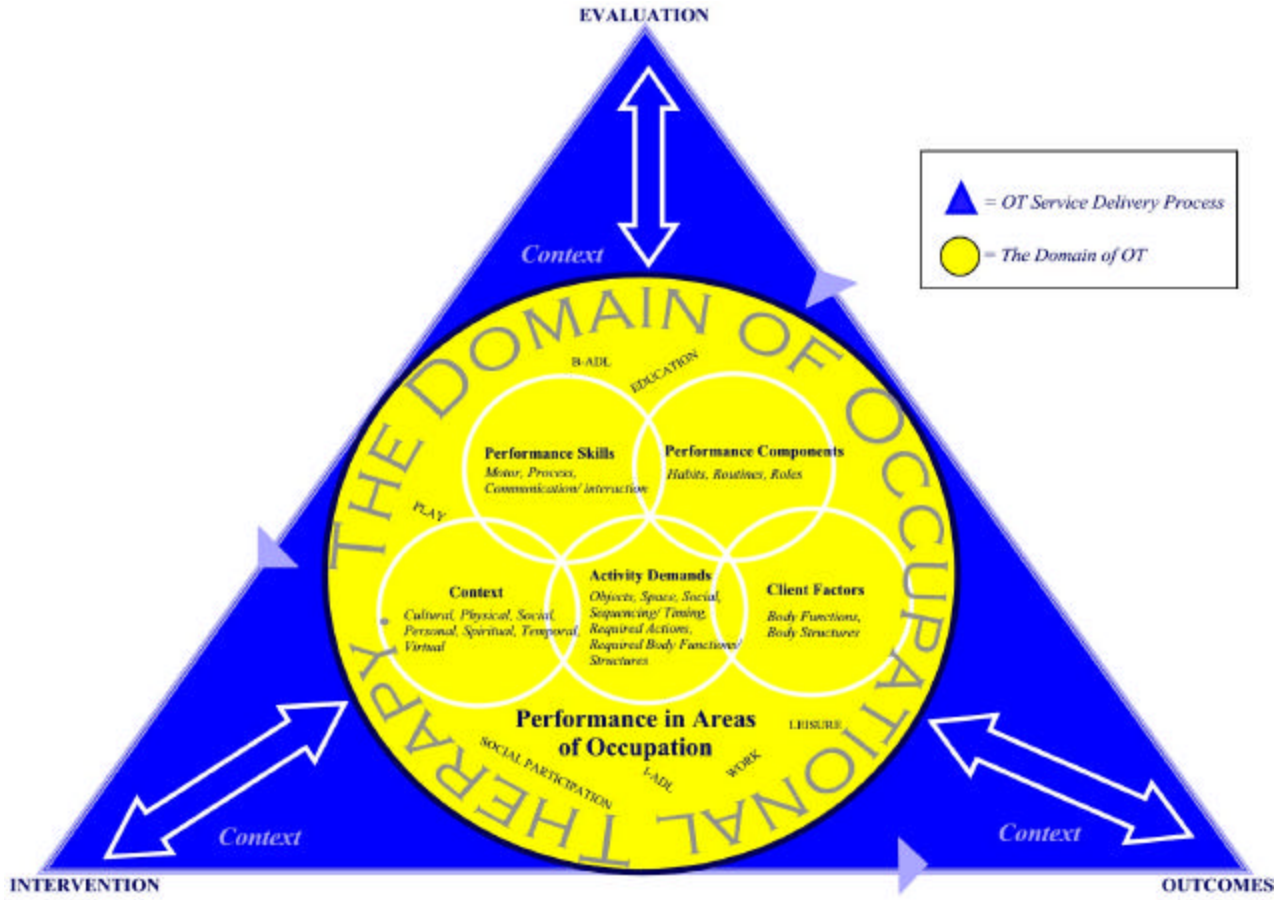

Figure 1.

Process of Service Delivery and Domain of Occupational Therapy (AOTA, 2002). This figure represents the interactive relationships amongst the stages of the process of service delivery, and the various aspects of the domain of occupational therapy.

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Effect of oral creatine supplementation ation and Pre-cooling on isometric strength and isometric endurance

Manocha Neha, Paul Maman, Sandhu S Jaspal
Department of Sports Medicine and Physiotherapy, Guru Nanak Dev University, Amritsar.

Abstract

Background & Purpose: Athletes use various Ergogenic aids to enhance performance capacity or the ability to perform work during various sporting events. The purpose of the study was to investigate the effect of oral creatine supplementation and pre-cooling on neuromuscular variables such as isometric strength and endurance.

Materials and methodology

30 healthy university level players participated in the different subject design, experimental study (Mean age 21.37±0.4 Yr, mean height 176.16±11.06cm and mean body weight 70.48±1.96). They were randomly divided into three groups (n=10) Creatine supplementation (20gm per day for 6 days), pre-cooling (20 minutes in water at 16±2ºC till iliac crest) and placebo group (cornstarch 20gm per day for 6 days). Following administration, subjects performed 2 isometric holds; one of 10 seconds duration and other of 60 seconds. Isometric angle specific peak force, average force and fatigue index of quadriceps in extension moment were measured.

Results

A significant increase in all the above mentioned variables ($p<0.05$) were observed after creatine supplementation but for pre-cooling a reduction in both average and peak force was observed. On comparison significant differences were observed for isometric endurance in the pre-cooling group as compared to the placebo group.

Conclusion

It is thus concluded that creatine supplement can act as an effective Ergogenic aid both in terms of isometric strength and endurance but pre-cooling effectively increases isometric endurance only within the investigated range.

Keywords

Creatine supplement, pre-cooling, peak force, average force, isometric endurance.

Introduction

Athletes have been continuously searching for an elixir to enhance their performance. For the same purpose use of various ergogenic aids (nutritional supplements etc.) has gained popularity among athletes in recent years[1]. Ergogenic aid is a technique or practice that serves to increase performance capacity, the efficiency to perform work, the ability to recover from exercise, and/or the quality of training thereby promoting greater training adaptations.[2]

Amongst ergogenic aids creatine is the most popular nutritional supplement used by the athletes. Creatine is found predominantly in skeletal muscle in which approximately 40% is the free creatine form, while the remaining 60% is in the phosphorylated form; creatine phosphate. It is used as a source of energy to replenish adenosine triphosphate (ATP).The rate at which ATP is hydrolyzed is dictated by the level of force production of muscle.[3] This is mainly achieved first through the accumulation of Pcr itself which is available as an immediate buffer to ATP use, and secondly by the facilitation of energy translocation from mitochondria to sites of ATP utilization.[4]

The stores of CrP (creatine phosphate) can fall to a level of zero with continued high intensity exercise and have been demonstrated to be finite. Consequently; CrP may have a limiting effect upon re phosphorylation of ADP to ATP and is commonly associated with onset of muscle fatigue.[5] Oral creatine supplementation is capable of increasing the total Cr content of skeletal muscle by 20-25%[4]. After creatine supplementation there is both an increase in

Reprint requests : Manocha Neha
MSPT Student, Dept. of Sports Medicine and Physiotherapy, Guru Nanak Dev University, Amritsar Ph no. +91-9888935181,
Email: nehamanocha@gmail.com

creatine pool and also an increase in rate of resyntheis. Both of these factors limit the rate of force decline with repeated sets of explosive work and enhance performance[6].

Beyond loss in strength and fatigue physical performance can be impaired by elevations in the core temperate (T_c), particularly during prolonged exercise. In an effort to reduce the elevations in T_c and possibly improve performance various cooling procedures and devices have been employed prior to exercise. Pre-cooling has become increasingly common as an Ergogenic aid before some athletic competitions. Lowering of body temperate before exercise (pre-cooling) can be beneficial to athlete's performing in hot and humid environments as it is well established that exercise is prematurely terminated in the heat.

The basis of pre-cooling strategy is to decrease body temperature before exercise, thereby increasing the margin for metabolic heat production and increasing the time to reach the critical limiting temperature when a given exercise intensity can no longer be maintained. Generally pre-cooling has been shown to increase time to exhaustion or increase the distance run or cycled. The various methods of pre-cooling are cold air, water immersion, water perfused suits and cold packs which can be employed with different exercise protocols, and environmental conditions.

The purpose of the experiment was to investigate whether creatine supplementation and pre-cooling exert an ergogenic effect on maximal force production and endurance of human quadriceps muscle.[7]

Materials and Methods

Subjects: 30 healthy university level players (footballers and runners) with Mean age 21.37±0.4 Yr, mean height 176.16±11.06cm and mean body weight 70.48±1.96 kg were included in the study.Prior history of use of any of the ergogenic aids were also taken into consideration. The experimental protocol and potential risks of the study were explained to each subject both verbally and in writing before and their informed consent was obtained. The study was approved by the local medical ethical committee.

Pre-experimental protocol: Subjects in all the three groups viz. Placebo, Creatine supplementation and Pre-cooling(n=10) were told to visit the testing laboratory before the start of the experimental protocol to determine base line readings of peak force(PF), average force (AVF) and fatigue index (FI) of the quadriceps femoris muscle of the dominant leg. Subject performed maximum voluntary isometric contraction with 10 second and 60 second hold with a rest period of 2 minute in between the two contractions, on HUR isotonic/isometric dynamometer (University of Technology in Helsinki, Finland) along with above mentioned strength testing protocol additionally in the creatine supplementation group a venous sample was drawn to analyze plasma urea and creatinine and body composition analysis was done. While in the pre-cooling group skin temperature was noted prior to the intervention.

Instuctions to subjects: The subjects were asked to refrain from any dietary modulations, heavy meals or any strenuous activity during the entire length of the study. Pre-structured standardized diet was given to the subjects in the creatine supplementation group to ensure avoiding any variability in the plasma creatinine level of the body.

Experimental protocol

The study utilized a pre test post test, different subject experimental design with all the three groups completed in a random order on separate days with a constant time of the day for each individual.

Group I-Creatine Supplementation

Subjects were given oral creatine supplementation in form of creatine monohydrate for duration of 6 days. A dose of 20 gm was given every day and the subject consumed creatine in 4 doses of 5 gm each. The subject was advised to consume creatine after meals. After the supplementation protocol on 7th day the blood sample and the test for Body composition were repeated.

Group II-Pre-Cooling

Subjects were exposed to pre-cooling of lower torso muscles. The subject was made to sit in a water tank with water level reaching upto the iliac crest. The water temperature was maintained at 16±2°C with crushed ice and the

subject was made to sit for a duration of 20 minutes on a stool placed in the water tank. Before and after pre-cooling the skin and rectal temperature were measured. The skin temperature was measured at thigh and calf and the mean was taken after the pre-cooling procedure the subjects were allowed to pat dry with towel and change clothes.

Group III-Placebo

Subjects were given placebo supplementation which consisted of 20 gm of corn starch per day in 4 divided doses of 5 gm each. The subjects were instructed to mix the powder in juice or beverage and to be consumed after meals. Post supplementation a blood sample was taken and body impedance analysis was done.

On the day of testing the subjects were asked to consume a light meal prior to the test. Following a 5-7 minute warm-up for the quadriceps, the PF, AVG and FI were measured at optimal standardized angle of the knee joint (60° of knee flexion; 0º= full knee extension), the angle at which the quadriceps muscle applies maximum force. The isometric test protocol was applied as per standardized procedure mentioned by HUR research line software user manual (Version 1.3)

Analysis: Isometric strength measurement: The torque (Nm) was measured at 10 sec isometric hold at 60° knee flexion for quadriceps in all the 5 groups. It was normalized to force (N) by dividing the torque (Nm) by lever arm length (m). Thereafter Peak Force (pf) & Average Force (avf) for 10 sec were calculated (avf of 4 quarters; 1 quarter=2.5 sec). Isometric endurance measurement: After 2 min rest with no activity, fatigue index (fi) was calculated as a measure of isometric endurance with the same seat position and knee angle as above. Isometric hold of 60 sec was performed, to calculate isometric endurance. Torque in 1st sec (T_1) and torque at 60th sec (T_{60}) were observed. Torque T_1 and T_{60} was normalized to force F_1 and F_{60} respectively. Fatigue Index designed by Milner and Brown et al. (1986) was calculated using the equation;

Fatigue index (fi) = $(F_1 – F_{60} / F_1) * 100$ (%)

No visual or verbal feedback was given during the test session to the subject so that no external stimuli were instituted except for the subject's own maximal effort and hold.

Data Analysis

Data was presented as mean ± SD. The data was analyzed for statistical significance by using the statistical package for social sciences (SPSS 14.0) software. The dependent variables peak force, average force & fatigue index were analyzed using one way analysis of variance (ANOVA) for statistical analysis of effect of different Ergogenic aids. Since significant differences were found ($p<0.05$) Multiple comparison Scheffe's (Post Hoc Test) was applied to test for differences between the groups The mean; standard deviation & standard error were calculated to describe the data.

Results and Analysis

For isometric strength: peak force and average force were examined using a 10 second isometric hold.

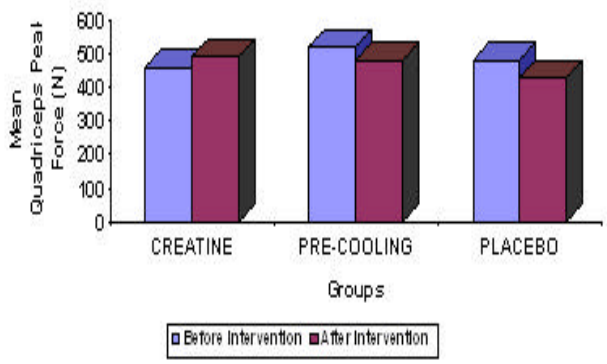
1) Peak force: on inter group comparison for mean peak force (N) of quadriceps before and after the interventions, it was found that creatine supplementation group gained strength significantly at (p£0.05) but there was a significant reduction in the strength of placebo group and pre-cooling group at (p£0.05) respectively.

Table-1: Comparison of quadriceps peak force before and after intervention in all 3 groups.

Group	Quadriceps Peak Force (N)	
	Before Intervention	After Intervention
	Mean	Mean
Creatine Supplementation	466.38±97.39	490.25±80.88*
Pre-cooling	518.96±134.46	461.42±147.96**
Placebo	480.58±69.78	429.03±78.15*

* indicates significance $p<0.05$ ** indicates significance $p<0.01$

Fig. 1: Distribution of mean values of quadriceps peak force (N) before and after intervention in all 3 groups.



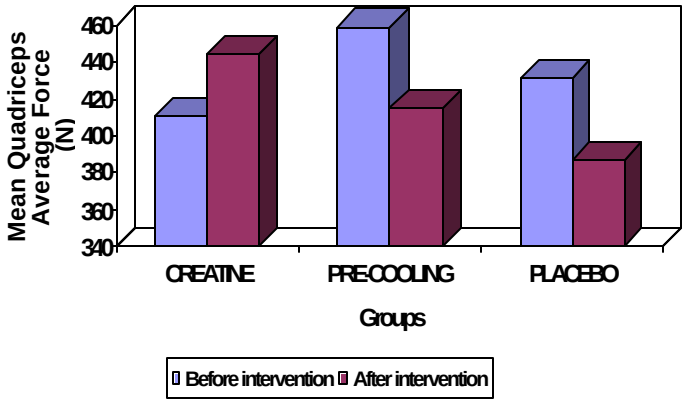
2) Average force: On inter group comparison of mean average force (N) of quadriceps before and after Intervention, it was found that the creatine group gained average force significantly at ($p<0.05$) on the contrary pre-cooling and placebo group significantly lost strength at ($p<0.05$) respectively.

Table-2: Comparison of quadriceps average force before and after intervention in all 3 groups.

Group	Quadriceps Average Force (N)	
	Before Intervention	After Intervention
	Mean	Mean
Creatine Supplementation	416.75±87.38	444.10±82.48**
Pre-cooling	458.79±128.22	415.05±138.74**
Placebo	431.03±66.88	386.13±76.01**

* indicates significance $p<0.05$ ** indicates significance $p<0.01$

Fig. 2: Distribution of mean values of quadriceps average force (N) before and after training in all 3 groups.



Isometric endurance: On inter group comparison of mean fatigue index (%) of quadriceps before and after intervention (taken as a measure of isometric endurance measured using a 60 second isometric hold) it was found that Creatine supplementation and pre-cooling group gained isometric endurance significantly at (p£0.05) whereas placebo group showed a significant reduction in isometric endurance at (p£0.05) respectively.

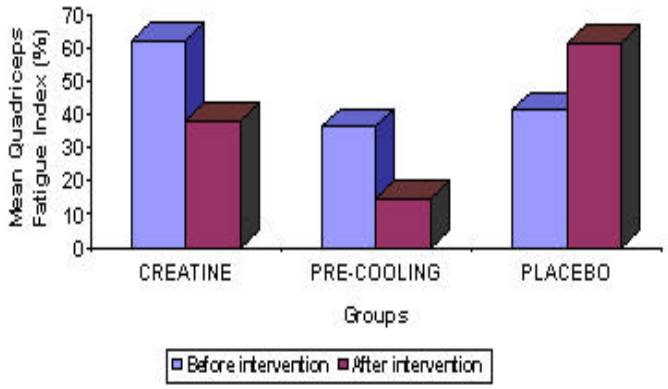
Table-3: Comparison of quadriceps fatigue index (%) before and after intervention in all 3 groups.

Group	Quadriceps Fatigue Index (%)#	
	Before Intervention	After Intervention
	Mean	Mean
Creatine Supplementation	62.13±62.23	38.06±41.21*
Pre-cooling	36.32±3.39	14.58±14.17*
Placebo	41.23±36.81	61.67±41.17**

* indicates significance $p<0.05$ ** indicates significance $p<0.01$

#Decrease in Fatigue Index (%) indicates increase of isometric endurance and vice versa.

Fig. 3:Distribution of mean values of quadriceps fatigue index (%) before and after training in all 3 groups.



Decrease in Fatigue Index (%) indicates increase in isometric endurance and vice versa.

Discussion

Isometric Strength

The result of the study showed that the trend for isometric curve was on increase with 8.1% in average force and 6.09% in peak force of quadriceps, in oral creatine supplementation group. These parameters were taken as a measure of isometric strength.

The energy required to perform brief explosive-type exercise is almost exclusively provided by the high energy phosphate stores in skeletal muscle.Creatine supplementation produces elevated muscle creatine phosphate(CrP) content which increases the capacity for ATP re phosphorylation (Cr +ADP?creatine +ATP $+H^+$) thereby increasing the potential to maintain high power output during repeated short bouts of supra maximal exercise, during which energy is primarily derived from the ATP-creatine phosphate system. This results in an increased peak power output following supplementation.

Luc et al (8) reported similar findings for isometric strength in a study twenty subjects who underwent five days of creatine supplementation (20gm per day) indicating an increase in the average power. Further, Maganaris et al (9) reported that the increase in Maximal Voluntary Contraction force (MVC) after creatine supplementation might be a result of neural or peripheral changes. This is consistent with the study conducted by Harris et al (4) also supported the notion that creatine supplementation might improve energy substrate availability during the later stages of sustained bout of high intensity exercises

Further, Hultman et al (3) reported that an increase in peak torque production after creatine supplementation may be a consequence of muscle buffering capacity being increased as a result of rise in muscle Pcr stores.

The results for the above mentioned parameter in the present study are in agreement with

the results of Greenhaff et al (10) and Urbanski et al (11) stating similar results on peak torque after creatine supplementation and reporting that creatine supplementation can increase maximal strength and time to fatigue during isometric exercise.

The implication of the study that creatine supplementation in sports persons can be an effective ergogenic aid to improve strength is in accordance with the findings of Lin et al (1) suggesting the use of creatine supplementation in conjunction with a good conditioning program can significantly increase more muscular strength and power than the good conditioning program alone.

The results for isometric strength however, are in contradiction to the findings of Bemben et al (12) concluding that oral supplementation with creatine monohydrate in untrained males does not positively influence isometric strength but may enhance intermittent isometric muscular endurance.

Further, Cooke et al (13) did not find a positive influence of creatine supplementation on power output or fatigue during continuous high intensity bicycle exercise in untrained men.

Studies investigating the effects of creatine supplementation on short term, high intensity exercises have reported equivocal results, with approximately equal numbers reporting significant and non-significant results.

Regarding pre-cooling in the present study results demonstrate a significant loss of strength with a decrease of 9.53% average force and 11.08% peak force in the pre-cooling group. Also a similar trend was observed in the control group with a 10.40% decrease in average force and 10.72% in peak force of quadriceps which were taken as a measure of isometric strength.

Asmusen et al (14) and sergeant et al (15) reported that decreased strength in the Pre-cooling group may be due to the reason that cooling the muscle results in changes that may impair short term muscular performance. However recent studies suggest that the impairments in muscle function last less than twenty minutes consistent with the studies of Further a rapid decrease in skin temperature with initiation of cooling significantly decreases peak torque, suggesting a significant contribution of local skin temperature on isokinetic strength, these results have been supported by the study of [Cheung et al (16)] reporting an impairment in isokinetic force production independent of core temperature in a study of twenty young healthy males who performed two maximal voluntary knee extensions.

Isometric enduranceI

The results of the present study showed an increase in the trend for isometric endurance with a 60.9% decrease in fatigue index of quadriceps for the Pre-cooling group, as fatigue index decreases endurance increases. This denotes an increase in the isometric endurance. Significant increase in muscular endurance in the pre-cooling group may be due to the reason that with exercise there is a decreased in the blood supply to the skin as a result of cold induced vasoconstriction. This probably is a reason for the delay in the onset of fatigue. These findings are consistent with those of

Smith et al (17) evaluating the effect of skin pre-cooling, at 10ºC on fatigue and reported a delay in the onset of fatigue. As pre-cooling lowers core and skin temperature this reduces the need for blood at skin. Also pre-cooling increases central blood volume and enhance blood delivery to the working muscles An increase in central blood volume may be potentially beneficial to maximal exercise performance, as it results in enhanced oxygen delivery resulting in a greater contribution of aerobic system to energy supply for any given power output [Marsh et al (18)].

For the creatine supplementation group there was a 38.74% decrease in the fatigue index, which was taken as a measure of isometric endurance. A significant increase in fatigue index by 49.5% and thus a reduction in muscular endurance was seen in Control group.

A significant result in the creatine supplementation group could be attributed to an increased post creatine supplementation Maximum Voluntary Contraction [Magnaris et al (9)]. A higher level of pre-exercise energy substrate availability [Harris et al (4)] and an increased buffering capacity [Greenhaff et al (10)] could also contribute to the increased endurance capacity. An increase in the endurance capacity could also be partially attributed to an improvement in

ADP homeostasis in the muscle after creatine supplementation. Such an effect could improve performance in two ways, first by maintaing the ATP / ADP ratio in the micro environment of the contractile proteins and therefore the energy charge of the muscle cell at optimum level. Secondly, an increase in resting ADP may result in earlier mitochondrial respiration in the muscle[Green et al (19)] which in turn would increase the contribution of ATP regeneration in the muscle cell from aerobic metabolism.

Conclusion

Summarizing the findings of this study to investigate and compare the effects of oral creatine supplementaiton and pre-cooling on isometric strength and endurance of quadriceps femoris muscle and also on aerobic power, it is concluded that a regime of 6 days of oral creatine supplementation (5gm x 4 doses per day) increases the isometric strength and endurance and also aerobic power.

Pre-cooling at 16±2°C results in an immediate loss in strength but isometric endurance and aerobic power is improved.

Results of the present study support the following conclusion:

* The regime of oral creatine supplementation, used in this study produced isometric strength gain whereas the protocol used for pre-cooling resulted in loss of strength post cooling.
* Both the protocols resulted in an improved isometric endurance but pre-cooling significantly improved isometric endurance as compared to creatine supplementation.
* Both the ergogenic aids resulted in an improved aerobic power but as compared to pre-cooling creatine supplementation significantly enhanced the aerobic power

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Effect of Medially Linked and Unlinked Knee Immobilizer on Paraplegic Gait Performance

***Singh Meenakshi, **Kataria Chitra**

*Lecturer IAMR, Ghaziabad, **Principal, ISIC Institute of Rehab Sciences, Delhi

Study Design

Randomized clinical trial.

Purpose

To evaluate the effect of attaching a medial linkage single axis hip joint to knee immobilizer on gait outcomes of paraplegic individuals. Knee immobilizers provide no control at the hips. Medially linking the two Knee Immobilizers serves to restrict mediolateral and rotational movements at the hip which could provide better stability and ambulation.

Setting

Rehabilitation department, Indian Spinal Injuries Centre, New Delhi.

Subjects

29 subjects with thoracic (T8- T12) spinal cord injury.

Material

knee Immobilizer, Paper walkway, Ink, Measuring tape, Stop watch.

Methods

Two groups A and B were formed. Group A (control group) underwent balance and gait training with unlinked Knee Immobilizer and Group B (Experimental Group) underwent same training with linked Knee Immobilizers. Both groups were given the training for 4 weeks within parallel bars for 40 min. each day for 5 days/ week. Gait analysis was performed after the gait training in both the groups.

Outcome Measures

Walking velocity, Cadence, Stride length & Foot angle were recorded using Ink-footprint record and ambulation time.

Data Analysis

Independent sample t-test was used to analyze the difference between gait outcomes. Correlation co-efficient analysis was done to find out the relationship between gait parameters.

Results

Significant differences existed in all gait parameters. Experimental group had increased velocity and cadence but reduced stride length and foot angle than control group ($p < 0.05$ for each parameter). Velocity and cadence were highly correlated with one another ($r > 0.76$).

Conclusion

Medially linked Knee Immobilizer has better gait outcomes as compared to linked Knee Immobilizer in Paraplegic individuals. However, the Energy factor should also be considered.

Key Words

Spinal Cord Injury, Paraplegia, Knee Immobilizer, Gait

Introduction

Spinal cord trauma or disease may result in an incomplete or complete active functional inability to stand up and to walk [(1)] Walking, an important activity of daily living, is a mode of bipedal locomotion in which a period of double support, when both feet are in contact with the ground, is followed by a period in which the body is supported by one lower limb while the other is swung forward [(2)] It is well established that the major functional loss following injury to the thoracic spine is the inability of the patient to independently stand up and walk in the environment encountered while engaging in normal daily activities. While the wheelchair can provide adequate replacement for the lost function, it leaves the patient with a set of secondary, but not unimportant, problems. They include contractures in the hip, knee and ankle; the formation of heterotrophic ossification of these joints: pressure sores: spasticity: reduced cardio circulatory and pulmonary functions:

Reprint requests : Dr. Meenakshi Singh
M.P.T. (Neurology), M.I.A.P., S-640, School Block, Shakarpur, Delhi-110092, Ph : 09818857487
E-mail: msphysio@gmail.com

and frequent urinary tract infection due to stagnation of fluids in the bladder [3].

Most persons with paraplegia are largely confined to a life in a wheelchair. Orthotic devices, however, enable some low level thoracic paraplegic persons to stand and walk with the use of walking aids [2] . Benefits of standing and ambulation with orthoses for paralyzed individuals have included reduction of osteoporosis and subsequent fracture, reduction of hypercalciuria and urinary calculi formation, reduction in spasticity, maintenance of joint range of motion and improvement in psychological well being [4].

During the past four decades, several orthotic devices have been developed to allow some patients to stand and walk with the use of walking aids [6]. Even if one agrees in theory that everyone should be given a chance to walk, the high cost of orthoses remain a barrier. It is hard to justify spending over lot of money on a pair of orthoses for a person with a high cervical lesion knowing that he is likely to give up ambulation after a few gait training sessions [6]. The Walkabout Orthosis (WO) is one such newer modular orthotic device [7].. It consists of two KAFOs joined by a single axis hip joint called the Walkabout Unit, which is positioned between the medial uprights of the KAFOs, under the perineum. It serves to restrict mediolateral and rotational movements of the hip. Also it provides an effective strategy to improve stability and increase postural control for persons with SCI, facilitating performance of functional activities during standing without upper limb support [7].

Despite these advantages, the high cost of such orthoses remains a barrier for the spinal cord injured to walk... To provide gait training to our paraplegic patients, Knee Immobilizers (Gaiters) are used which are much cost effective than other orthoses. And is the primary source of locomotion in patients of low socio- economic status. These knee immobilizers lock the knees during the entire gait cycle. Also locked knees allow the patient to lean backward to stabilize the hips. Leaning backward with locked knees places the centre of mass of the trunk behind the hip joint resulting in tightening of anterior hip capsule providing internal stabilization of the hip. There is no control at hips or ankle.

To provide better stability and ambulation by these gaiters and, these knee immobilizers have been linked medially under the perineum by a single axis hip joint which serves to restrict mediolateral and rotational movements at the hip.

So, the main Aim of the study was to evaluate the effect of attaching a medial linkage single axis hip joint to Knee Immobilizers on gait outcomes of paraplegic individuals.

Review of Literature

There are three types of gait used [8]. - swing-to-gait; four-point gait; and swing through gait. Controlled walking is achieved only through perseverance, perfect timing, rhythm, and co-ordination. The patient is taught always to move the hands first, to walk slowly and place his feet accurately, to take the weight through the feet and so ensure that the hands can relax between each step, and to lift the body upwards and not to drag the leg forwards. For ambulation over even surfaces for four-point gait, the physical prerequisites are adequate strength in Serratus anterior. Pectoralis major, Latissimus dorsi and Triceps. Also there must be full range of motion in elbow extension, hip extension and knee extension [8]. in the gait training of SCI individuals, use of orthosis is an important part of ambulation. .Stallard and associates [9] reviewed fundamental design problems of providing ambulation for paraplegic patients. The prescriber must be aware of both, the fundamental requirements and the compromises made by the developers of the system under consideration. The fundamental components of an orthotic locomotion are stability, mobility and control.

Before prescribing any orthosis for patients it is essential to take into consideration the relevance of these components of locomotion and their absence, if any, in the patients who are being supplied with the orthosis. In those with complete paraplegia almost all of these basic requirements are absent and an orthoses is supposed to provide one or more of these requirements.

Presently there are three approaches which can be considered in the provision of orthosis for a paraplegic patient for an ambulation.

1. Mechanical orthosis.
2. Functional electrical stimulation (FES)
3. Hybrid orthosis- combination of a mechanical orthosis and FES.

The new system (a HKAFO with a medial single hip joint (MSH- KAFO)[7] is a unique orthotic system invented by Stewart McKay in 1992, characterized by its medial single hip joint (Walkabout unit, Polymedic, Gold Coats, Queensland, Australia). It consists of bilateral Knee Ankle Foot Orthosis and the Walkabout unit. A single axis hip joint, which is located between the thighs of KAFOs under the perineum, has attaching portions to the KAFOs designed for removable use. The medial linkage which works by hinge mechanism restricts hip abduction, adduction and rotation, but does not mechanically assist hip flexion [7]

When assessing functionality of a particular orthosis, used for ambulation by paraplegics, certain factors should be taken into consideration. They are:

1. Energy cost of walking.
2. Independence
3. Cosmesis
4. System reliability- fail safe features
5. Finances

Gait analysis- the systematic analysis of locomotion- is used today for study of neuromuscular disorders [10] and evaluation of orthotics and assistive devices [10] Temporal-distance (TD) parameters measurement is a clinically feasible, quantitative approach to gait assessment [11] The system is inexpensive, is easy to learn, takes little time to administer, and has been well studied in neurologically impaired individuals. Unlike traditional qualitative gait assessments, using measurements such as velocity or stride length permits easy quantification of change and comparisons of outcomes across different subjects or treatments. The significant relationship of velocity, cadence, step and stride length, and SL: LEL to functional ambulation status supports the validity of their use outcome measures.

Walking index for spinal cord injury. A walking scale for use in multi-center trials was currently published and documented face validity, concurrent validity and inter-rater reliability (11). The WISCI II has 20 levels of walking and is unique because it integrates the use of devices, both for the arms and legs and physical assistance into a hierarchical order. Arm device for walking include the parallel bars, walkers, crutches and canes, while leg devices include short and long leg braces. The WISCI is unique in that it is a functional capacity scale that is based on hierarchical ranking and integrates both gradations of physical assistance and devices. [12]

Methodology

Number of subjects: A sample of convenience of 30 subjects with spinal cord injury.

Source of subjects: ISIC Hospital, vasant kunj, New Delhi.

The criteria for selection of subjects were:

Inclusion criteria

* Spinal cord injury subjects at least 3 months post injury with a stable spine and no significant kyphoscoliotic deformity.
* Neurological level from T8- T12.
* ASIA Impairment grade A or B
* Spasticity (grade 1/ 1+)
* Medically stable.
* Full range of motion in hip, knee and ankle.
* Ability to stand in parallel bars for at least 15 minutes (level 0 on walking indexof spinal cord injury WISCI II scale).

Exclusion criteria

* Any complication such as pressure sores, urinary tract infection, autonomic Dysreflexia, postural hypotension.
* Visual impairment (if any, then successful use of corrective lenses).
* Any painful musculoskeletal or joint problems affecting upper limb.

Method of selection

All the spinal cord injury patients attending the rehabilitation department of ISIC Hospital were evaluated and those meeting the inclusion and exclusion criteria and willing to give consent to participate in the study were included in the study.

The subjects were then randomly allocated into two groups: Group A (control, which received gait training with unlinked gaiter) and Group B (experimental, which received gait training with linked gaiter).

Design of the study

Randomized controlled experimental design.

Instrumentation for data collection

1. Knee Immobilizer with / without medial attachment (Mechanism of medial linkage the medial linkage acts by hinge mechanism. It is a single axis hip joint which restricts hip abduction, adduction and rotation, but does not mechanically assist hip flexion. The linkage is mounted on the inner aluminum bars of the knee immobilizers of both sides. The width of the linkage is 5 cms).
2. **Parallel bars with a length of 5 meters.**
3. Paper walkway.
4. Digital stopwatch.
5. Oil paint.
6. A standardized inch tape & scale.

MEDIALLY LINKED KNEE MMOBILIZER

Variables used in the study

Independent variable: unlinked and medially linked knee immobilizers.

Dependent variables:

1. walking velocity
2. cadence
3. stride length
4. Foot angle.

Procedure

Participants were explained about the purpose and the nature of the study and the informed consent was obtained from those willing to participate.

Demographic details and the history like the name, age, gender, and body weight, time since injury, injury level, ASIA level, functional leg length and level on WISCI II (walking index for spinal cord injury) were obtained.

Protocol for gait training

All subjects were given balance and gait training for 4 weeks in parallel bars for 40 minutes each day for 5 days / week.

Gait assessment

At the completion of the gait training programme, gait assessment was performed for all subjects within the parallel bars on a 5 meter walkway. Subjects, made to walk on the walkway, were fitted with their gaiters with / without medial linkage.

Each subject initially walked from right to left and following a 45- 60 second break for turning, walked from left to right. By noting the time spent walking to each direction, an average walking speed was obtained.

Numbers of steps per minute were counted to calculate the cadence.

Footprints were taken with the help of oil paint applied on the sole of the patient. Stride length and foot angle were recorded.

Stride length was calculated by measuring the distance from heel strike of one extremity to the heel strike of the same extremity again in the next step using a standardized scale. Stride length was divided by the functional leg length for each subject to normalize the differences in the patient's leg length.

Foot angle was calculated by measuring the angle formed by each foot's line of progression and a line intersecting the center of the heel and

the second toe.

Three trials were taken for each assessment and the mean for each outcome measure calculated.

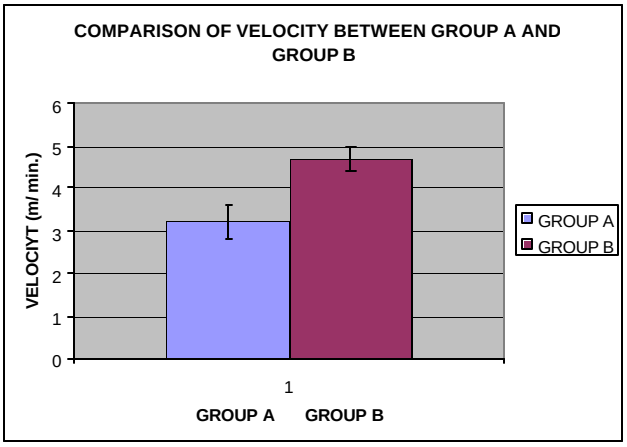
Adequate rest periods were given in between the testing as per the patient's will.

Data was recorded in gait analysis recording form along with the other details of the patient. Patients in each group were assessed for their levels of walking on WISCI II scale at the end of 4 week gait training.

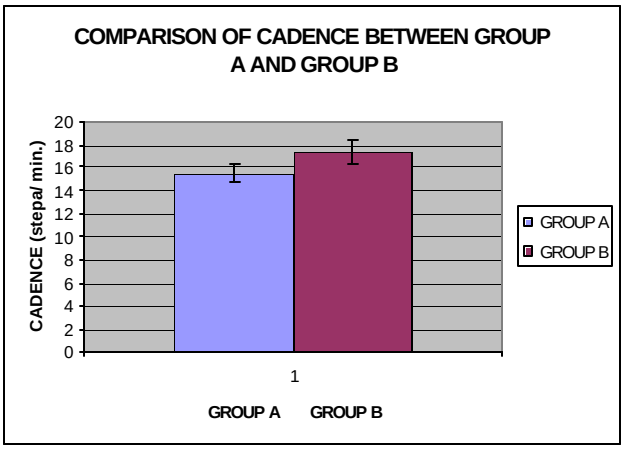
Data analysis

Statistics were performed using the STATA 7.0 and SPSS software. An independent sample t test was used to analyze the difference between the performances of the subjects in the two groups (A and B) after the intervention, which showed a significant p value. Correlation co-efficient analysis was done to find out the relationship between various gait parameters.

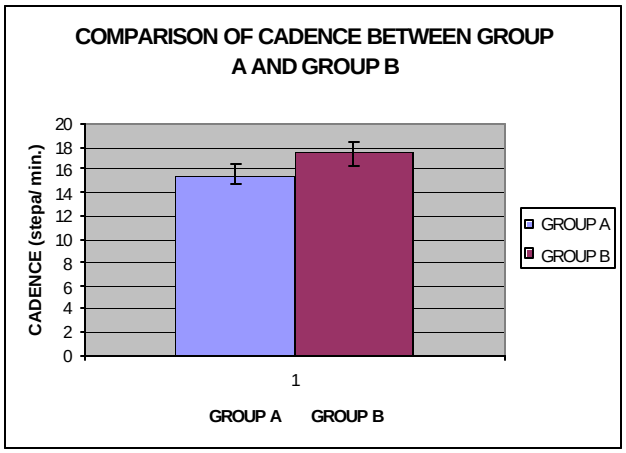
Results



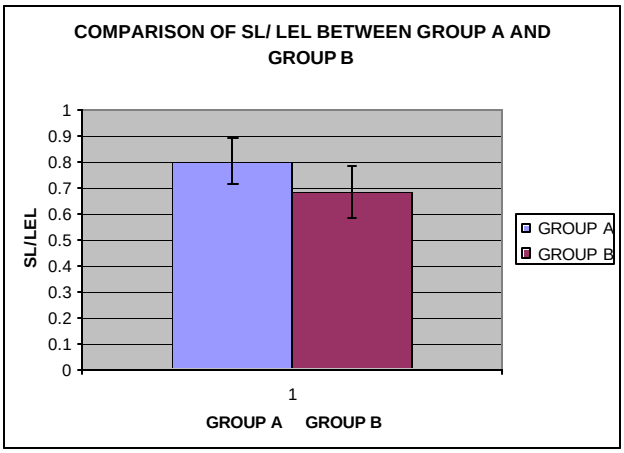
Graph 1



Graph 2



Graph 3



Graph 4

Comparison of gait parameters between two groups.

There was a significant difference in Velocity between Group A (3.22 +- 0.42) and Group B (4.69 +- 0.31). Cadence between Group A (15.49 +- 0.94) and Group B (17.33 +- 0.99).). SL / LEL between Group A (0.80 +- 0.09) and Group B (0.68 +- 0.10). Foot angle between Group A (15.92 +- 0.67) and Group B (10.70 +- 0.64).).

Correlation of gait parameters

A significant positive correlation (r = 0.78) was found in Group A when values of velocity were compared with values of cadence and Group B(r = 0.76) when values of velocity were compared with values of cadence. A non significant positive correlation (r = 0.48) was found in Group B when values of velocity were compared with values of SL / LEL.

Discussion

The main findings were that subjects with linked gaiters walked more fast (4.69 m / min) than those with unlinked one (3.22 m / min). Also cadence of subjects with linked gaiter (17.33 steps / min) was slightly more than that of persons with unlinked gaiters (15.49 steps / min). Ratio of stride length to lower extremity length for persons with unlinked gaiters was 0.80 and those with linked gaiters were 0.68. Degree of toe out for persons with unlinked gaiters was 15.92 and those with linked gaiters were 10.70. All results were significant ($p < 0.01$).

In recent years gait has been made possible for thoracic paraplegics through the use of different orthoses which provide mobility and stability. Assistive systems for paraplegic standing and walking have to be designed with consideration of functional factors, realistic factors, and other factors. Of course, the main functions of the system are stable standing and walking functions, but velocity and energy costs are also important critical factors for the quality of walking.

Medial linkage in the Knee Immobilizers provides a new orthotic option to assist standing and short distance mobility in paralyzed individuals which differs significantly from unlinked Knee Immobilizers. The medial linkage was designed as an additive to existing Knee Immobilizers with the hope of improving some of the practical and functional difficulties experienced by SCI individuals.

As is evident from the comparison of gait parameters of two groups of patients wearing unlinked and linked Knee Immobilizers / Gaiters, patients using linked Knee Immobilizers have better gait outcomes than those of the other group. Both groups were given equal duration of gait training sessions of 4weeks within the parallel bars. Velocity, cadence and stride length were chosen because they are basic gait parameters which reflect a person's gait.

Medial linkage serves to restrict medio-lateral and rotational movements of the hip. Velocity of walking was more than that of persons with unlinked gaiters. This was the result of increased cadence and shorter stride length .[14] Difference in height between the position of orthotic hip joints and physiologic hip joint seems to be responsible the shorter stride length as taking the longer step would require the forward horizontal rotation of hip and thus making patient unstable. Therefore, patient can not take longer steps[17]. Also restriction of rotational movements of hip seem to be responsible for Reduction of degree of toe- out (10 deg) which is quite near to normal value (7 deg).[14]

Also patients were judged on WISCI scale to document any change in their levels of walking before and after the gait training. Prior to gait training, all the patients in both the groups were at level 0 but after gait training session of 4weeks, patients wearing linked gaiter reach level 9 while those with unlinked gaiter were at level 5. This was solely due to the inherent stability and batter speed of walking with linked gaiter making the patient to progress to ambulation with walkers earlier.

However the gait speed remains slow close to 0.078 m / sec in normal use compared to gait speed achieved by a healthy person (1.58 m / sec.). This could be due to absence of ankle support orthoses but this could make the gaiter heavy leading to slower speed of ambulation and increased energy expenditure. Also, the Knee Immobilizer provides limited stability at hip and trunk. Thus, when walking with the gaiters, subjects must expend greater effort in maintaining an upright stance- effort that could otherwise be directed into forward propulsion.

The Knee Immobilizer may have initial appeal because it eliminates the need for a thoraco-lumbar corset but the slow speed of walking (as compared to other orthosis) mitigate against its use as an ambulatory orthosis. It may, however, be useful for individuals who wish to use their wheelchair primarily for mobility, but who need to walk short distances or who want to repeatedly stand up during the day for access.

Future research The obtained results in the study aimed at evaluating the effectiveness of medially linked gaiter over the unlinked gaiter in paraplegic gait performance are highly encouraging. In the future, there is a need to include more number of subjects to evaluate the effectiveness of the linkage. The duration of gait training period should be increased in order to reach more conclusive information. Also, it is intended to evaluate the effectiveness of the modified orthosis in other functional areas such

as stair climbing and crossing obstacles. The limitation provided by the attachment to the hip range of motion can be used to study its effectiveness in case of spasticity of lower extremity.

Clinical implications

Most persons with paraplegia are largely confined to a life in wheelchair.

Orthotic devices, however, enable some low level thoracic paraplegics to stand and walk with the use of walking aids. There are many physical and psychological factors why these patients should be encouraged to ambulate with orthoses where and when feasible. But weight, energy expenditure and cost inefficiency of these orthoses create a barrier for successful ambulation. The apparent advantage and appeal of the medially linked gaiters is that it doesn't have a thoracolumbar corset and is consequently less cumbersome. In addition, the medial attachment has very low cost and gives better walking velocity than unlinked gaiters. Also, it enables patients to progress from ambulation in parallel bars to that in walkers early. Thus, a small change in the make of the existing orthoses can help our paraplegic patients achieve better ambulation. However, the energy cost of this device is still to be investigated.

Conclusion

The findings support the hypothesis that medially linked knee immobilizer has better gait outcomes as compared to unlinked knee immobilizer in paraplegic individuals. However, the energy factor should also be considered.

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Effects of Repeated Sauna Bathing on ECG

Gaurav Shori, J.S. Sandhu

Department of Sports Medicine & Physiotherapy, Guru Nanak Dev University, Amritsar

Abstract

Background and Purpose: Cardiac disease is considered as one of the contraindication of sauna bath however there is paucity of evidence supporting this statement. The purpose of the study was to investigate the repeated effect of modality on heart during its application. Previous works in our department have examined the effects of single session of sauna bath. The effects of repeated exposure to the sauna remains uninvestigated, keeping this in mind the study aims at examining the effects of 5 session of sauna on ECG.

Material and Methodology

20 healthy male volunteers were exposed to the dry heat of sauna (70±2ºC) for 15 minutes for a period of 5 days and pre & post recording of all the parameters was done. On day 2, besides pre & post recording subject is rehydrated i.e. drink water equivalent to loss of weight and again recording of all the ECG parameters was done after 5 minutes.

Results

After each exposure heart rate rose by 10-12 beats / min ($p<0.001$). No ECG changes were found in recordings taken in all the 5 days i.e. no significant differences were found in the duration of P wave, PR interval, QRS, QT & QTC interval. Rhythm remained sinus after each sauna exposure & ST segment of the heart did not change significantly.

Conclusion

It is thus concluded that repeated sauna bathing exerts minimal stress on heart function in the healthy male subjects. On day 2, heart rate remains still on the higher side and significant decrease were found in the mean values of QRS & QT interval after rehydration. Further research is needed to explore this finding.

Keywords

Sauna Bath, ECG

Reprint requests : Shori Gaurav
MSPT Student,
Department of Sports Medicine and Physiotherapy,
Guru Nanak Dev University, Amritsar
Ph.: 91-9888325277,
Email: gorushori@yahoo.com

Introduction

Repetitive high intensity exercise is performed in many sports. The final outcome in these sports might be influenced by the athlete's ability to perform maximally at a given time. It is of great importance that the athlete's recover from an intense exercise bout as rapidly as possible[1]. Adequate recovery is essential if the athlete is to benefit fully from training and prevent injuries from occurring. Inadequate recovery impairs performance and causes fatigue and lethargy. To guarantee success optimal recovery should be as fast as possible. There are varieties of methods which sports people utilize for enhancing the rate of recovery, these methods range from active cool down to passive procedure such as massage, underwater massage, stretching, showers, or mechanical relaxation techniques[1]. These methods are aimed at reducing the fatigue. Sauna bath is also used as one of the important modality to hasten the recovery process[2]. Sauna is a dry hot air bath in which the air temperature is between 60°C and 90°C. The relative humidity of the air should be between 5-10%. Sauna bathing dates back more than thousands years. Sauna is ancient method of relaxation of well being which is used till now. It was used in 1936 Olympics in Berlin[2]. It has long been accepted as well as utilized in Finland and now a days spreading to other countries as well. Sauna bath exerts several physiological effects. Some of the marked physiological effects of sauna are hyperthermia, sweating, cardiovascular changes and cutaneous circulatory changes.

It has been generally accepted that the body surface potentials are greatly influenced by the intraventricular blood mass. The relation between the body surface potentials and intraventricular blood mass has been commonly

recognized as the Brody effect. On the basis of the brody effect, the body surface potentials should be increased with increase in intraventricular blood mass and vice-versa. Recently one of the authors found that the decreased intraventricular blood volume due to haemodialysis caused an increase, not a decrease in the QRS voltage which may be understood as a reversed brody effect[3] .The circulating blood volume is apparently decreased by profuse sweating in sauna bathing. It can reasonably be expected, therefore that the intraventricular blood volume may be reduced by sauna bathing. Thus sauna bathing may provide a good clinical model by which the inter-relation between the body surface potentials and an acute reduction in the intraventricular blood mass can be re-evaluated.

Statement of Problem

Sauna bath is a widely used method to facilitate recovery among persons & cardiac disease is considered as a contraindication of this modality, however experimental evidences regarding the adverse effects of modality on heart are not widely reported. There exists a need to find out the effect of modality on heart during its application. Studies on the effect of sauna bath on Indian population have not been widely reported. Previous works in our department have examined the effects of a single session of sauna bath on various parameters. The effects of repeated exposure to the sauna remain uninvestigated. Keeping this in mind the study aims at examining the effects of 5 session of sauna on ECG.

Aim of Study

To find out the effects of 5 session of sauna bath on ECG.

Design & Methodology

Research design: The research design for the present study was same subject experimental design.

Sample: The sample consisted of 20 healthy males of GNDU campus, Amritsar with the mean age 23.2±2yrs & mean body weight 63.87±6.8kg.

Inclusion criteria:

- ✧ The age group between 18-30 years.
- ✧ Healthy adults with out any contraindication of sauna bath.

Exclusion criteria

- ✧ Subjects with any cardiac disorder (recent myocardial infarction, severe aortic stenosis & heart failure).
- ✧ Subjects with malignant tumour.
- ✧ Subjects under any medication.
- ✧ Subjects with metal pins, rods, artificial joints or any other surgical implants.
- ✧ Subjects with adrenal suppression.
- ✧ Subjects with any acute injury.
- ✧ Subjects with skin infection.

Pre-Experimental Protocol

All the subjects were familiarized by showing the experimental equipments and describing the procedure one day prior to sauna bathing. The potential risks of the study were explained and informed consent was obtained. The study was approved by the local medical ethical committee.

Instruction to subjects

The subjects were asked to refrain from any strenuous activity and consume food 2 hours prior to the procedure.

Experimental Protocol

In 5 days protocol, before going into the sauna bath subjects were given 5 minutes rest following tap water shower. Then recording of ECG was done. Following that subjects were asked to sit in the sauna bath for 15 minutes at the temperature of 70±2ºC. After completing the sauna phase subjects were taken out and ECG was recorded again.

On day 2, besides pre & post recording of variables subjects were asked to drink water equivalent to the loss of weight and following that after 5 minutes all the ECG variables were recorded again.

Results

I. Heart Rate

Table 1: Comparison of heart rate (beats/min) data Pre vs Post sauna on day 1-day5.

Days	1	2	3	4	5
Before exposure	70.65±9	68.35±9.8	69.35±9.6	69.85±9.4	71.95±8.7
After exposure	82.55±13.4***	80.05±13***	81.9±13.8***	83±11.4***	82.35±11.9***

***Statistically significant changes ($p<0.001$) between pre vs post sauna heart rate comparison.

II-VI parameters showing one way ANOVA analysis of duration of P wave, PR, QRS, QT& QTC interval from day1-day5.

II. P wave

One way ANOVA analysis of duration of P wave showed that the calculated F value (between groups) 1.28 was less than the critical value [$F_{9, 171}$=1.92] at $p<0.05$. There were no significant differences found in the duration of P wave. This indicates P wave duration was not affected by sauna application.

III. PR interval

One way ANOVA analysis of duration of PR interval showed that the calculated F value (between groups) 1.76 was less than the critical value [$F_{9, 171}$=1.92] at $p<0.05$. There were no significant differences seen in the duration of PR interval.

IV. QRS interval

One way ANOVA analysis of duration of QRS interval showed that the calculated F value (between groups) 0.72 was less than the critical value [$F_{9, 171}$=1.92] at $p<0.05$. No significant differences were found in the duration of QRS interval.

V. QT interval

One way ANOVA analysis of duration of QT interval showed that the calculated F value (between groups) 1.77 was less than the critical value [$F_{9, 171}$=1.92] at $p<0.05$. No significant differences were found in the duration of QT interval.

VI. QTC interval

One way ANOVA analysis of duration of QTC interval showed that the calculated F value (between groups) 1.43 was less than the critical value [$F_{9, 171}$=1.92] at $p<0.05$. There were no significant differences seen in the duration of QTC interval. This indicates QTC interval was not affected by sauna application.

Table 2: Comparison of the mean values of pre sauna & after rehydration on day2 for heart rate (beats/min).

	Day 2
Before sauna exposure	68.35±9.8
After sauna exposure	72.25±12*

* Statistically significant increase ($p<0.05$) were found in comparison of pre sauna & after rehydration values.

Table 3: Comparison of the mean values of pre sauna and after rehydration on day2 for ECG parameters.

	P wave	PR interval	QRS interval	QT interval	QTC interval
Pre sauna	114±25.2	148±20.6	96.5±17	398.25±25	383.25±75.5
Post sauna	114±36.6	146.5±27.9	91.75±15.5*	387.75±33.1*	388.25±45

*Statistically significant decrease ($P<0.05$) were found in the mean values of QRS & QT interval after rehydration in comparison with pre sauna values.

Discussion

Sauna bath is an ancient method of relaxation & is also used as one of the important modality to hasten the recovery process. Often it is cited that heart abnormality are the contraindication of sauna bath. It is expected that sauna bath would produce significant alteration in heart contractility and rhythm[4], however the experimental evidences in this regard are scarce, & contradictory[5]. Considering this, present study aimed at exploring the effects of repeated sauna bath on ECG.

Heart Rate

In the present study after each sauna exposure in all 5 days, heart rate is significantly elevated approx. 10- 12 beats / min. But this increase in heart rate was transient. Similar findings have been reported by other investigators[6, 7]. Roine et al. (1992) and Sudakov (1988) also reported increase in heart rate. The magnitude of change as reported by different workers varies considerably. This probably reflects variations in environmental condition of the sauna bath, changes in heart rate is also modified by physical training, frequent exposure to the hot environment, constitutional characteristics or by age and sex. The possible stimuli for the increased heart rate during sauna bath include direct effects of the elevated blood and body temp on the brain[8], reflex action from arterial[9], venous[10] or cardiac receptors[11] and pulmonary nerve endings[9] .

In the present study heart rate remains still on the higher side 72.25 beats / min after rehydration on day 2, as compared to its pre value 68.35 beats / min.

ECG

In the present study no significant differences were found in the duration of P wave, PR, QRS, QT & QTC interval. In all the subjects, rhythm remained sinus after exposure of sauna bath i.e. no change was there in the pre & post status.

ST segment of the heart did not change significantly & it remains almost identical to pre sauna. The finding of present study on ECG is in agreement with the Leppaluoto et al. 1986 & Sherif et al, 1970. However it is in variance with the studies of various other authors[4, 12, 13, 14].

Leppaluoto et al. (1986) did not found any changes in various time intervals or in ST segment which was taken performance sauna and 2-4 hr after the last sauna. The ECG recording PR, PQ, QRS intervals and ST segments were similar before and on the 1st to 7th day of experimental protocol.

Sherif et al. (1970) found no significant changes in ECG in the normal and bilharzial corpulmonale patients, apart from sinus tachycardia with apparent ST segment depression while their experiment was conducted at the temperature of 40ºC for 2 hrs.

Jokinen et al. (1991) observed some common ECG changes besides increase heart rate, like flattening of the T wave, a minimal depression of ST segment. Most of the ECG changes occurred during repolarization of the cardiac muscles. the main reason for T wave flattening during heat stress was probably the accentuated sympathetic activity. Paolone et al. (1983) found ECG, changes characterized by greater J point displacement, prolongation of QT interval and loss of T wave amplitude during recovery by the sauna exposure at 70-74ºC for 10 min. these changes were associated with reduction in diastolic blood pressure, elevated core temperature and greater myocardial oxygen demand. Loss of T wave amplitude in response to intense heat is possibly associated with a decrease in stroke volume.

Sohar et al. (1976) observed T wave depression in 12 subjects, ST segment depression in 10 subjects, tall, pointed symmetrical T waves in 8 subjects, out of 60 subjects at the temperature of 80-90ºC for 20 mins. Other ECG changes found were ventricular extra systole, supraventricular tachycardia, deep S wave. They concluded that combination of tachycardia, high pulse pressure and increased body temperature appears to place a heavy burden on the cardiovascular system and is responsible for ECG changes.

Lundgren et al. (1938) who noticed several ECG changes such as increase in amplitude of the R wave, in lead I and lead II, the ST segment was depressed and the T wave flattened. These changes were thought to be caused by an intense stimulation of the sympathetic nervous system.

As revealed by all the findings, ECG changes may occur due to following reasons in the sauna bath i.e. elevated core temperature, increase heart rate, increase cardiac output, accentuated sympathetic activity, increased circulating blood volume and increased myocardial oxygen demand.

Conclusion

The main finding of this study can be summarized as follows:

* Various time intervals of ECG did not change significantly during and after 15 minutes of sauna bathing at the temperature of 70±2ºC in all 5 days.
* ST segment of the ECG did not change significantly during and after 15 minutes of sauna bathing at the temperature of 70±2ºC in all 5 days.
* Significant elevation in heart rate is observed following each exposure of sauna bath in all 5 days.

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The Effect of External Sensory Cues on Parkinson's Gait after Deep Brain Stimulation Surgery.

Fuzail Ahmad*, Vinay Goel, Leena Dhawan***, Mona Maurya******

*M.P.Th. (Neuro), Lecturer, Hamdard University, New Delhi, **DM, Assistant Professor, Dept. of Neurology, AIIMS, New Delhi, ***M.S. PT., Temple University, USA. Lecturer, Hamdard University, New Delhi, ****M.P.Th (Neuro), Head Neurophysiotherapy Unit, Dept. of Nurology, AIIMS, New Delhi.

The purpose of this study was to examine the immediate effects of the visual cues on the selected gait parameters in PD patients after DBS. Thirty volunteer subjects (25 men and 5 women) with a mean age of 55.4 + 7.1 years, ranging from 39 to 68 years, all exhibiting, moderate to severe gait dysfunction. According to a standard protocol, all the subjects were made to walk five lengths of 12 meter walkway, under three testing conditions. Assessment of gait performance in this experiment included five dependent variables; gait speed, cadence, step length, stride length and step width. One-way MANOVA demonstrated a significant difference in gait performance among the three conditions. Further analysis was performed to determine which dependent variable was significantly different among the conditions by using a follow-up univariate analysis of variance. Among the three conditions, there was a significant difference for gait speed ($F = 70$, $p<0.005$), gait cadence ($F= 15.3$, $p<0.001$), step length ($F=273$, $p<0.001$), stride length ($F= 138.56$, $p=.001$), but stride width was found to be not significant ($F=0.64$, $p<0.53$) all possible pair wise post-hoc comparisons were performed on gait speed, cadence, step length, and stride length, to compare conditions. These results indicate that the use of visual cues improves the temporal and distance parameters of gait in Parkinson's patients with deep brain stimulation.

Key words

Parkinson's disease, sensory cues, deep brain stimulation, physical therapy.

Reprint requests : Fuzail Ahmad
M.P.Th. (Neuro), Lecturer,
Hamdard University, New Delhi.
Email: fuzail_ad@yahoo.co.in,
Phone: 91-11-26059688 Ext-5740 / 42,
Mobile: 91-9873745609
Fax : 91-11-26059663

To receive a diagnosis of a chronic neurological illness is the beginning of a long journey into the unknown, a journey that may begin in hope, pass through period, of elation and frustration, and finally end in acceptance and resignation. The map of Parkinson's disease (PD) is full of unknown territories and nameless threats. People begin the journey with different knowledge and different ways of accepting the disease. The average age for developing PD is around 65, although up to one in 10 people with the disease develop it in their 40s or 50s. Globally, PD affects 6.3 million people, with one in 10 people receiving a diagnosis before age 50.[1]

After 5 to 7 years of treatment with levodopa 40% to 50% of patients with PD develop complication in the form of motor fluctuation and dyskinesia. With further disease Progression motor complication develop and it may be impossible to obtain satisfactory mobility without dyskinesias. Subthalamic nucleus deep brain stimulation is considered surgical management for PD and it improves rigidity, akinesia and tremor[2] A significant reduction in parkinsonian sign and off drug related phenomenon has been found after bilateral high frequency deep brain stimulation (DBS) of the subthalamic nucleus (STN).[3] In the long term after STN DBS in advanced PD, some symptoms more particularly gait, postural reflexes and speech, tends to become resistant to levodopa and stimulation, reflecting progression of disease.[4]

Gait disturbances are among the most troubling problem experienced by Parkinson's disease patients. Their gait pattern is typically characterized by, hesitant, shuffling steps which are short and quick, flexed forward posture with limited natural arm swing, and difficulty initiating and / or altering their gait patterns.

Central to these gait problems is the inability of PD patients to generate, proper stride length,

which is compensated by an increased gait cadence. Various studies have stated that cadence control remains unaffected throughout its entire range in PD and the gait hypokinesia is directly attributed to an in ability to generate sufficiently large steps.[5-7]

Physiotherapy is considered to be a useful adjunct to the medical treatment of this disorder. Both gait training and exercise therapy have been used by therapist to treat these patients. Dunne et. al. reported PD patients improved their gait by using inverted walking sticks as a visual cue.[8] Subsequent studies supported Dunne's findings related to the advantages of visual cues for the improvement of gait patterns of PD patients. Martin also reported improved gait for Parkinson's disease patients' when they traversed a walkway with brightly colored lines as visual cues[9]. Other studies reported improvement in stride length with visual cues marked on the floor.

Auditory signals are another form of cueing reported to be helpful for improving PD patient's gait. Cueing techniques such as musical beats metronomes or rhythmic clapping have been implemented as strategies for improving gait for PD patients.[10] An increase in the speed and number of steps, to complete a walking course, compared to uncued walking has been found to occur and also a reduction in the number of freezing episodes has been documented. The use of a metronome is clinically appealing because it is easy to use, portable and relatively inexpensive.

Purpose and significance of study

Physiotherapy is widely used in the association with the pharmacological treatment in the management of PD, particularly in the advance stages of the disease. Conflicting results however, have been reported concerning the efficacy of physiotherapy, and there is no general consensus on the specificity of rehabilitation program most suitable for DBS patients.[11] The use of sensory cues to improve gait in PD patients has been established as an effective assistance for improving gait. And several encouraging studies exist, stating the effectiveness of the cueing strategies. Although sensory cues are commonly used in clinical practice, in the rehabilitative management of PD, I was unable to find any clinical research examining the effectiveness of visual cues on mobility function for PD patients with DBS.

The purpose of the present study was to examine the effect of visual cues applied individually on the gait patterns of Parkinson's disease patients after deep brain stimulation, with the aim of assessing the possible role of providing external sensory cues in the rehabilitation of PD patients. Results from this study may help to establish simple strategies for addressing motor difficulties encountered by individuals with PD after the subthalamic DBS.

Sample

Thirty volunteer subjects (25 men and 5 women) with a mean age of 55.4 + 7.1 years, ranging from 39 to 68 years, all exhibiting, moderate to severe gait dysfunction as a result of idiopathic Parkinson's disease even after deep brain stimulation. All were able to walk without walking aids or assistance for a distance of at least 64 meters. To get a uniform sample the subjects were evaluated and selected according to their score on the Hoehn and Yahr disease severity scale and the patients with PD of moderate severity with deep brain stimulation, Hoehn and Yahr stage 3-4 when on levodopa, complaints of akinesia and freezing, and willingness to participate were included in the study. Exclusion criteria were, neurological pathologies other then Parkinson's disease, cardiovascular or orthopedic impairments that would limit the ability to initiate gait, visual, hearing, or coetaneous sensation impairments of such a degree that they would affect a participant's ability to recognize a cue, the presence of severe on/off L-dopa motor fluctuations or dyskinesias. Any cognitive condition that would affect the ability of the participant to follow directions. A pre test- post test experimental design, for the effect of intervention on the dependent variables was selected.

Material and method

Approval for the study was obtained from the Institutional Review Board Jamia Hamdard University, New Delhi. Persons with PD who have undergone deep brain stimulation were recruited from the inpatients/outpatient movement disorders clinic/ward, Department

of Neurology All India Institute of Medical Sciences, New Delhi.All measurement was collected during a single session. All subjects were asked to walk five lengths of the 12 meter long walkway at their preferred speed which was defined as, that speed at which they could walk most comfortably. A standard verbal protocol was followed by the researcher accompanying each subject. Between each walk the subjects were given a 60-second rest period when they sat in a chair placed at the end of the walkway. The walks were undertaken in the following order:

* Walk A: Familiarization trial
* Walk 1: No cue - data collected
* Walk 2. Cue - data collected
* Walk B: Cue - no data collected
* Walk 3: No cue - data collected

The cues were used were bright yellow triangular tubes. Each visual cue was 90 cm long and about 2 cm in height. Two factors were considered when determining the location of the cues. It has been found that on average, the stride length of the patient with Parkinson's disease was half that of age matched controls. Martin reported that placing white lines 45 cm apart produced a marked increase in the ability of the patient to step[12]. As a result of these findings, the cues were placed at 150% of the initial step length of each individual subject.

A pilot study confirmed that this distance is safe and attainable for each subject. These cues therefore were placed across the walkway at distance calculated for each individual. All subjects were taking medication to improve functional performance. The varying effects of, anti-Parkinson medications were minimized by conducting the test in the second hour post-medication. The time required to test each subject was under 30 minutes, well within this 60 minute window.

Fig 3.1 Baseline reading (walk1)

Fig 3.2 Visually cued walking (walk2)

Fig 3.3 Post test readings of a patient (walk3)

Procedures

The purpose and schedule for the experiment was explained to the participants and questions were answered upon their entering the laboratory. Participants then gave informed consent; Age, co-morbidities and current medication intake were recorded from all participants. Data was collected according to the protocol. For all trial, patients were instructed to walk at their preferred along the pathway. In order to reduce acceleration and deceleration effects, subjects the first and the last meter of the pathway were not included in the readings. Time required to complete the 10 meter (effective length) course was recorded in seconds using a digital stop watch. Average gait speed was calculated and expressed in centimeter / seconds the number of steps required to complete each trial was counted and used to calculate the average cadence in steps / minute. Average stride length and step length was calculated and expressed in centimeters.

Data Analysis

All analysis were obtained using SPSS Windows version 11.0, demographic data of patient including sex, age, disease duration , Hoehn and Yahr disability stage were descriptively summarized. The dependent variable for statistical analysis were, gait speed, gait cadence, stride length, step length, and step width. A one way multivariate analysis of variance (MANOVA) with repeated measure was performed. To assess differences of gait performance among the three conditions, uncued baseline data, visually cued, and uncued post test data. An á-level of 0.05 was used to determine statistical significance. Follow up analysis of variance were conducted if the MANOVA test demonstrated statistical significance. Further, an all possible pair wise post hoc analysis was conducted on the significant dependent variable in order to compare differences between conditions. To prevent an inflation of type one error or to maintain á at p=0.05 for this follow up test; a Bonferroni corrected post-hoc test was used.

Result

	1 n=30 M ± SD	2 n=30 M ± SD	3 n=30 M ± SD	Repeated Measures ANOVA	
				F	P
stw	7.28 ± 0.91	7.38 ± 1.09	7.26 ± 0.69	0.641	.53
cad	67.5±13.8	83.9 ± 11.5	77.8 ± 10.7	18.35	.00
wkvel	0.33 ± 0.11	0.69 ± 0.16	0.55 ± 0.15	89.33	.00
strl	60.6 ± 14.4	92.3 ± 11.2	73.0 ± 15.93	92.177	.00
stp	28.03 ± 5.5	44.6 ± 6.5	35.0 ± 7.83	136.50	.00

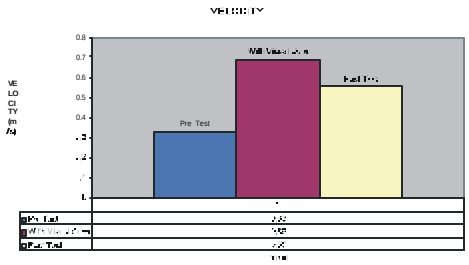
Significant at p<0.05

Effect of Cueing on Gait Performance

Assessment of gait performance in this experiment included five dependent variables: gait speed, cadence, and step length, stride length and step width. One-way MANOVA demonstrated a significant difference in gait performance among the three conditions. Further analysis was performed to determine which dependent variable was significantly different among the conditions by using a follow-up univariate analysis of variance. Among the three conditions, there was a significant difference for gait speed (F = 70, p<0.005), gait

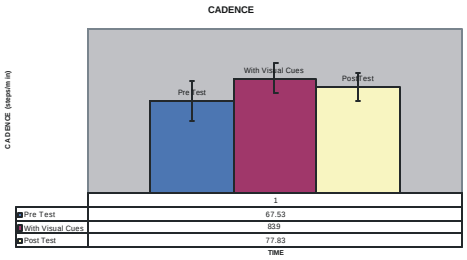
cadence (F= 15.3, p<0.001), step length (F=273, p<0.001), stride length (F= 138.56, p=.001), but stride width was found to be not significant (F=0.64, p<0.53) all possible pair wise post-hoc comparisons were performed on gait speed, cadence, step length, and stride length, to compare conditions. Results are presented in the following sections.

Effect of visual cue on walking speed



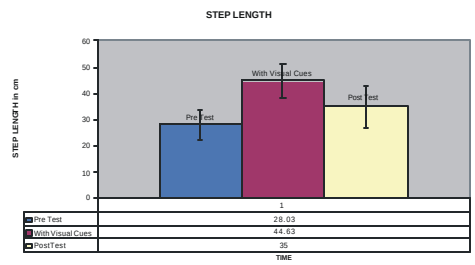
Post-hoc comparisons showed significant differences for gait speed between the base line, visual cued and post test conditions p< 0.001 Gait speed for the visually cued condition was 109% greater than the baseline condition and the post test condition was 66%, greater than the base line.

Effect of visual cue on cadence



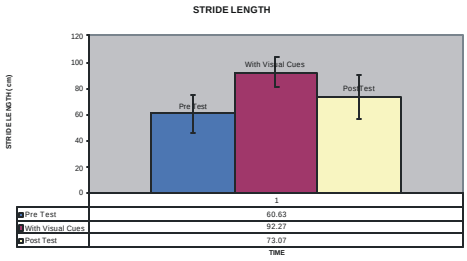
The inclusion of cues significantly impacted gait cadence. Compared to the uncued condition. Visual cueing increased gait cadence by approximately 24% (p<0.001), and the post test cadence was greater by approximately 15% (p<0.001). The difference between all three conditions was significant.

Effect of visual cue on step length.



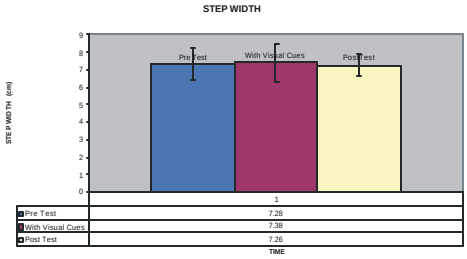
In accordance to gait speed and cadence the visual cue had significant effect on step and stride length (Fig. 5.3, 5.4).

Effect of visual cue on stride length.



However, the visual cue condition resulted in a significantly greater step and stride length than the, uncued post test condition by approximately 27% and 26% (p<0.001) respectively

Effect of Cueing on Stride Width



In contrast to other dependable variables the visual cues had no significant effect on stride length (Fig. 5.5)

Discussion

This study of 30 patients with Parkinson's disease, undergone deep brain stimulation, all of whom were capable of independent gait, showed statistically significant changes in stride length and step length between walks with visual cues and in the non-cued walk which immediately followed. These results indicate that the use of visual cues brings the gait pattern closer to that seen in normal subjects. They also support the existing physiotherapy practice of facilitating the gait of Parkinson's patients by the use of visual cues, although the long-term benefit of this strategy is yet to be established.

It has been shown that providing external or visual cues can improve specific feature of bradikinesia or gait. These results were not simply the results of a practice effect, because an after effect can be consistently demonstrated after the training phase. In this regard it should be pointed out that even in the study of Platz et.

al. in which the use of external cues did not lead to a greater improvement, a better retention of performance gains, was never the less was observed in cued condition.[13]

The main explanation for the benefit associated with cueing is based on the hypothesis that cueing makes the motor task less automatic and enables the patient with PD to modify their motor strategies to perform a 'closed loop' performance. External sensory cues can help patients with pd switch from one movement component of a sequence to the next, thus compensating the defective internal trigger from the pallidum to SMA.

Gwyn N Lewis[14] concluded that both static and dynamic visual cues are able to improve the hypokinetic spatiotemporal gait pattern of individual with PD. from the result of this study it is suggested that improvement in the PD gait pattern with the use of visual cues may arise through the patients ability to utilize visual feedback to regulate movement amplitude, reducing their reliance on kinesthetic feedback.

In PD, with disrupted BG output, the internal cueing mechanism may be impaired: both the termination for preparation activity for the current sub movement is, abnormal, resulting in impairment in the switch from one movement component to the next. Such defective internal control mechanism may account for the movement performance deficit associated with non cued movement in Parkinson's disease.

In the presence of external cues however, movement performance in PD subjects is dramatically improved. It has been found that when external cues provided, defective internal control mechanism may be bypassed, allowing less impaired control of movement.

Morris[15] et. al. suggested that the provision of external cues for gait gave PD patient an internal representation or model of the correct stride length, which they could subsequently attend to and produce in the absence of cues.

Similarly, Georgiou[17] et. al. showed that the speed of movement was greatly improved for PD patient by the provision of an auditory pacing cues set at the average rate of movement for control of sub movement speed and may have acted simply to draw their attention towards the aspect of the task.

The presence of external cues may not be important for improving movement performance in PD rather the underlying cognitive strategy used by the patients, which may be facilated by the presence of external cues, may determine the differences in motor control process and subsequent movement performance. It is suggested that external cues may normally act to draw the patient's attention towards particular aspect of the movement to be performed, such as an appropriate stride length or movement speed.[17] In this way, external cues may facilitate the use of more conscious attentional motor control strategies which are less impaired by basal ganglia dysfunction and consequently improve movement performance in PD.

As previously mentioned, it was felt that the visual cues were chiefly responsible for the differences detected. Other possible influences which could have affected the outcome were the effect of the ingestion of medication, stimulation parameters and the subjects themselves.

To overcome these extraneous variables the walkway used in the study was selected to permit the subjects to walk unencumbered and as naturally as possible. It is most unlikely, therefore that this variable could have caused the difference noted. The effect of medication was minimized by the timing as described above, so it was unlikely that bloodstream medication levels over the duration of the test would bias the results of the study. The stimulation parameters were also remained constant during the course of data collection and hence the chances of it biasing the study are remote.

The use of a standardized protocol by the researcher, who accompanied the subjects while they were being tested, decreased the likelihood of the provision of unintentional verbal or visual cues during data co1lection. The use of subjects who had a disease rating of 3 or 4 on the Hoyen and Yahr rating scale did not control the variability between subjects. The subjects also varied considerably in age (39-68 years). Such a variation may account for some of the differences between the walks. However, as previously noted, the wa1k with visual cues and, the carryover walk had smaller standard deviations

for the parameters examined, thus bringing subjects with initially extreme values closer to the mean for the group.

This study examined only five walks, three of which were measured. An evaluation of the effect of multiple repetitions of walking with and without the visual cues, increase in the distance walked using visual cues, together with a randomization of the order Of the walks, would also provide more information on the effectiveness of visual cues as a remedial therapy in which more permanent gains were being sought.

In keeping with the hypothesis we can postulate that our patients with PD who practiced cued physiotherapy developed new strategies and attention strategy which allowed a better motor activation and a longer lasting benefit. Of course it is possible that with a protracted follow up the short term improvement might cease to be apparent with a return to base line level. This indeed would suggest that rehabilitation procedure should be constantly applied and reinforced and possibly incorporated into the patient's lifestyle.

It could be proposed that the use of visual cues, which are specifically designed to improve the spatial characteristics of the gait pattern, have a more lasting effect, on the spatial measures of stride length, step length, cadence and velocity. The improvements in Parkinsonian gait observed in this study are encouraging for both Parkinson's patients and for physiotherapy practice. The results were felt to be clinically relevant because they are clearly observable in the clinical setting, changes in stride length and step length can easily be measured objectively by using a tape measure to define a distance and counting the number of steps taken over the measured distance. These results are also important for the patients who could be taught to transfer the concept of the cues into everyday situations. When in public for example, the patient could establish their own visual cue or attempt the use of visual imaging.

The generalization of these results should, at this time be limited to the, patients who fall within the population characteristics of this study. Further studies should be conducted to examine the effectiveness of visual cues for patients in both the mild and severe categories of the disease.

In conclusion the present data suggest intricate changes in the sensorymotor integration underlying Parkinson's disease patients increased dependence on external cues for movement initiation. These changes may be related to compensatory mechanism or strategy that evolves with the disease incorporates the alteration in cortical physiology caused by the disease.

Doctors are the chroniclers of the journey. I hope that close collaborations will help us to develop models of integrated care that will draw together the best in modern medical practice using all the strengths of the multidisciplinary team and involving the patients themselves. They should not forget that many patients value physiotherapy as much as, if not more than, medication, to help them move and remain active.

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Event Calendar

6th International Myotonic Dystrophy Consortium Meeting
September 12-15, 2007, University of Milan, Milan, Italy
This is the first announcement for the 6th international myotonic dystrophy meeting, organized by Dr. Giovanni Meola.
http://www.idmc-6.com/

12th International Congress of the World Muscle Society
17-20 October 2007, Giardini Naxos, Taormina Mare (Messina), Sicily, Italy
The symposium will be in the traditional WMS format with 3 selected topics: 1. New developments in metabolic disorders of muscle (including disorders of glycogen, lipid metabolism and mitochondria), 2. Update on congenital muscular dystrophies and congenital myopathies, 3. What's new in therapy of neuromuscular disorders?
http://www.worldmusclesociety.org

Moving and Handling People 2007
Business Design Centre, London N1
January 31 - February 2
http://www.movingandhandlingpeople.co.uk

27th Annual Scientific Meeting of the Australian Pain Society
1 - 4 April 2007
Adelaide Convention Centre
http://www.dcconferences.com.au/aps2007/posters.php

23rd International Seating Symposium
Orlando, Florida, USA
March 8-10, 2007
WEBSITE: www.iss.pitt.edu

The 23rd Annual Pacific Rim Conference on Disabilities
Honolulu, Hawaii, USA
March 12-14, 2007
WEBSITE: www.pacrim.hawaii.edu

87th American Occupational Therapy Association Annual Conference & Expo
St. Louis, MO
April 20-23, 2007
WEBSITE: http://www.aota.org/nonmembers/area29/links/link02.asp

International Society for Magnetic Resonance in Medicine
Barcelona, Spain
May 12-18, 2007
WEBSITE: http://www.ismrm.org/meetings/index.html

World Physical Therapy Conference 2007
Vancouver, BC
June 2-6, 2007
WEBSITE: http://www.physiotherapy.ca/congress20042007.htm

Canadian Association of Physical Medicine and Rehabilitation Annual Scientific Meeting
London, ON
June 13-16, 2007
WEBSITE: http://www.capmr.medical.org/agm2007.htm
Festival of International Conferences on Disabiltity,Aging & Technology
Growing Older with a Disability Technology and Aging Advances in Neurorehabilitation Caregivers: Essential Partners in Care Toronto, Ontario, CANADA

June 16-19, 2007
WEBSITE: www.ficdat.ca
TRANSED 2007
Montreal, Quebec, CANADA

June 18-21, 2007
WEBSITE: www.tc.gc.ca/transed2007
International Spinal Cord Society
Reykjavik, Iceland

June 27-July 1, 2007
WEBSITE: www.sci-reykjavik2007.org
Deadline for abstract submission: November 27, 2006

12th World Congress of the International Society for Prosthetics and Orthotics
Vancouver, B.C. CANADA
July 29 - August 3, 2007
WEBSITE: www.ispo.ca/congress

European Seating Symposium
Dublin, Ireland
May 2-4, 2007
Call for abstracts deadline: September 30, 2006
Biomedical Engineering Society
Los Angeles, CA

October 11-14, 2007
WEBSITE: http://www.bmes.org/meetings.asp
Society for Neuroscience
San Diego, CA

November 3-7, 2007
WEBSITE: http://apu.sfn.org/index.cfm?pagename=annualMeeting

Book Review

By

Archna Sharma, Editor, IJPOT

Fundamentals of Physiotherapy - edited by Praveen Kumar, Parvathi Raju, Venkata Prasad, Published by Jaypee Brothers Medical publishers New Delhi Ist Edition 2005 ISBN 81-8061-412-3 Price Rs 200/- pp 136

This book is an introduction to physiotherapy. The basic physiotherapeutic techniques have been described in detail. The book is divided into four sections namely general, exercise therapy, electrotherapy and other. All the sections have been covered well. The book has been written in a simple language which can be easily followed by a fresher in physiotherapy. Lot of illustrations is used to make concepts clear. The editors are themselves well read and enjoy high respectability in the profession. The book would also be useful for physicians and other paramedical staff dealing with patient care. In short, it is a good book which is reasonably priced. The quality of printing is quite good.

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