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Contents

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Editor-in-Chief: Prof. (Dr.) S.K. Verma

I am happy that the **Volume 9, No. 2 issue** of **Journal of Exercise Science and Physiotherapy** ***(JESP)*** is ready for release for the readers. This issue of JESP contains eleven research reports on the different important aspects of exercise science. **Goyal & co-workers from Mullana, Haryana,** examined the effects of the combined effect of end range mobilization (ERM) and mobilization with movement (MWM) in patients with frozen shoulder. They concluded that the combination of manual therapy (ERM+MWM) should be incorporated in the treatment protocol of frozen shoulder patients to achieve better gain in the ROM. **Singh et al from Punjab** studied the mechanical power variables of leg extensor muscles in male handball players and investigated the relationship between them. They reported that jumping test might offer the possibility of evaluating the mechanical power of the leg extensor muscles during explosive stretch-shortening type exercises. **Gajanana Prabhu from Karnataka** studied the effects of proprioceptive exercise training on joint reposition sense and balance in athletes with knee joint injury. They report that the proprioceptive exercise training during post injury rehabilitation has beneficial effects on joint position sense and balance of athletes with knee injury. **Gaurav et al** from Faridabad, Haryana concluded that Multi-station training show greater improvements as compared to conventional balance trainingin improving vertical jump performance. **Omole** et al from Osun State. Nigeria, assessed the pattern of neurological conditions in children seen at the physiotherapy department of a Nigerian tertiary hospital. They report that Paediatric neurological conditions constitute a huge burden for physiotherapy in Nigeria. CP and traumatic sciatic nerve palsy were the most common neurological conditions. **Goyal et al from** Mullana, Haryana observed the effect of back extension exercise on quality of life and back extensor strength of women with osteoporosis. They concluded that both the back extension exercise and back isometric exercise are effective in increasing back extensor strength and improving quality of life; however their results further suggest that back extension exercise is more effective than back isometric exercise in increasing back extensor strength and improving quality of life in post menopausal osteoporotic female patients. **Kumar, Ashok & Reena** from Punjabi University, Patiala, Punjab studied the relationship between the effects of different workload and load volume (i.e. 3 RM, 6 RM, 9 RM) of power clean on blood lactate production in female weight lifters. They concluded that the blood lactate response depends upon the maximum absolute load lifted by the weight lifters as compared to the volume of load lifted**. Kumar, Ashok & Vishal from Punjab** compared sports-related visual abilities - hand-eye response time and visuospatial intelligence of athletes to nonathletes and concluded that participation in different sport activities is beneficial to both eye-hand response time and visuospatial intelligence.
Singh, Shinku Kumar from Nanded, Maharashtra compared the incidence of injuries sustained due to causes among three groups of competitive football players and concluded that there was statistically significant difference of incidence of injuries with respect to causes. **Jagga & coworkers from Panipat, Haryana** reported the nerve conduction properties of median nerve in healthy male labourer for dominant and non dominant hand**.** The results of their study indicate that there is no statistical significant difference in median motor nerve conduction properties as well as in median sensory nerve conduction properties of dominant and nondominant hand of labourer sample. **Kumar, Ashok and coworkers from Patiala, Punjab** studied the practice of physiotherapy in Neonatal and Paediatric Intensive Care Units (NICU and PICU) in Punjab state. They reported that not all of the patients get routine physiotherapy from the professionally qualified physiotherapists as part of their NICU and PICU stay in hospitals located in Punjab. **Verma, Leena from Punjab University, Chandigarh** presents a case report of Hypoplasia of a Permanent Incisor Produced by Primary Incisor Intrusion. In this case report localized malformation of the crown of the permanent maxillary right central incisor and enamel hypoplasia were treated with a light-cured composite resin restoration. The unerupted permanent left central incisor was removed surgically. The study also discusses the management after extraction with removable partial denture.

S.K. Verma

Combined Effect of End Range Mobilization (ERM) and Mobilization with Movement (MWM) Techniques on Range Of Motion and Disability in Frozen Shoulder Patients: A Randomized Clinical Trial

Goyal[1], M., Bhattacharjee[2], S., Goyal[3], K.
[1]Ass. Professor & Head, MM Institute of Physiotherapy & Rehabilitation, MM University, Mullana, Haryana, India
[2]MPT Student, MM Institute of Physiotherapy & Rehabilitation, MM University, Mullana, Haryana, India
[3]Senior Physiotherapist, CLR Hospital, Gadholi, YamunaNagar

Abstract

The purpose of the study was to find out the combined effect of end range mobilization and mobilization with movement in patients with frozen shoulder. A total of 30 patients (male =16; female=14) were selected as subjects and they were further divided into 3 groups respectively (Group A=ERM; Group B=MWM; Group C=ERM+MWM). Each group comprising of 10 subjects (Group A & B male=6, female=4; Group C male= 4, female= 6). The results of the present study suggest that there was an improvement in the mean values of Range of Motion (both active & passive) and Shoulder Pain Disability Index scores after treatment in all the 3 groups. But it was found that an improvement was statistically significant more in the group C than the group A & B respectively. It was concluded that the combination manual therapy (ERM+MWM) should be incorporated in the treatment protocol of frozen shoulder patients to achieve better gain in the ROM & SPADI scores.

Keywords: ERM, MWM, Frozen Shoulder, ROM, Disability

Introduction

Frozen shoulder syndrome is a condition of uncertain etiology characterized by a progressive loss of both active and passive shoulder motion *(Yang et al, 2007)*. It occurs in the general population with an incidence of approximately 2% and of these 20 to 30% develop the condition bilaterally *(Binder et al, 1984)*. The condition is characterized by an insidious and progressive loss of active and passive mobility in the glenohumeral joint due to joint contracture *(Vermeulen et al, 2000)*. It is more common in females, age between 40-60 years *(Khan et al, 2009)* and in the non-dominant arm. Pain and stiffness noted in these patients was not due to arthritis, but rather, was due to soft tissue pathology of the periarticular structures. There is slow onset of pain felt near the insertion of deltoid, inability to sleep on the affected side, painful and restricted elevation and external rotation, with a normal radiological appearance *(Bunker, 1997)*. The loss of passive range of external rotation has remained pivotal to the diagnosis of frozen shoulder. *Kelly et al (2009)* described the classification system identifying primary frozen shoulder as idiopathic and secondary shoulder as posttraumatic and proposed the classification where primary frozen shoulder and idiopathic adhesive capsulitis are considered identical and not associated with a systemic condition or history of injury. Capsule and synovium thickness greater than 4 mm is a specific and sensitive criterion for diagnosis of frozen

shoulder *(Emig et al, 1995)*. The complete loss of external rotation is the most important factor in differential diagnosis. To regain the normal extensibility of the shoulder capsule, passive stretching of the shoulder capsule in all planes of motion by means of end-range mobilization techniques (EMTs) has been recommended but data to support the use of these treatments are lacking *(Yang et al, 2007)*. *Vermulen et al (2000)* showed effective result of End Range Mobilization after 3 months of treatment. There are an increasing number of reports that showed clinically beneficial effects of Mulligan's mobilization-with-movement (MWM) treatment technique *(Mulligan, 2000)*. The most frequent reported effect is that of an immediate and substantial pain reduction accompanied by improved function. Mulligan showed effective results in patients treated with frozen shoulder *(Mulligan, 1992)*. The purpose of the study was to find out the combined effect of end range mobilization and mobilization with movement in patients with frozen shoulder.

Materials & Methods

The 30 patients of frozen shoulder both male and female in the age range of 40 to 60 years were selected as subjects after obtaining their consent based on inclusion and exclusion criteria of the study. The subjects were further divided into three groups: Group-A (n=10), Group-B (n =10) and Group C (n=10). Both the group A (ERM) and group B (MWM) was further comprising of six male and four female subjects each respectively. Group C (ERM+MWM) comprises of four male and six female subjects.

Treatment Protocol: The subjects of Group-A underwent End range mobilization *(Hengeveld & Banks, 2005)* for flexion, abduction, external rotation & internal rotation along with conventional physiotherapy programme for 2days/week for 3 weeks, session of 30 minutes total duration. Three sets of 10 to 15 repetitions with 1 minute rest in between of intensive mobilization techniques, varying the plane of elevation or varying the degree of rotation in the end-range position, were applied during these techniques *(Yang et al, 2007)*. The subjects of Group B were given Mobilization with movement *(Mulligan, 2006)* along with conventional physiotherapy programme for 2days/week for 3 weeks, session of 30 minutes total duration. While performing all these techniques, the glide was sustained during slow active shoulder movements to the end of the pain-free range and released after return to the starting position. Three sets of 10 repetitions were applied, with 1 minute between sets.

The subjects of Group C were given combination of ERM+MWM as described above in Group A and Group B respectively. All the three groups were given conventional physiotherapy *(Kumar et al, 2012)* comprising of posterior capsular stretching in cross-body reach position using the opposite arm done by the subjects in all the groups. Duration- Each stretch was performed 5 times per day in a minute for total of approximately 15 minutes per day & basic pendular exercises (three times daily for 2-3 minutes). The scores of range of motion (both active & passive) & SPADI (Shoulder Pain and Disability Index) of

each subject of Group-A, Group-B & Group – C were recorded before and after 3-weeks. The data was analyzed using statistical computer software 'SPSS16 free trial version'. The mean, standard deviation & one way ANOVA- test was used for between group comparisons of ROM and SPADI. Post HOC analysis-Tukey's test was used for significant interactions between groups and to find which group is better. The results were found to be significant at $p< 0.05$.

Results & Discussion

The mean age and BMI of the subjects of Group –A, Group-B & Group C were 48.60±5.37 years, 50.40±5.85 years & 47.90±4.35 years; 25.10±1.524 Kg/m^2, 25.10±3.446 Kg/m^2 & 25.70±1.160 Kg/m^2 respectively. It was found that the difference in the mean values of age and BMI in all the three groups were not statistical significant.

Table 1. Comparison of Age & BMI

	Group-A	Group-B	Group-C	p-value
Age (years)	48.60±5.37	50.40 ±5.85	47.90 ±4.35	0.55
BMI (Kg/m^2)	25.10±1.52	25.10 ±3.446	25.70 ±1.160	0.795

*significant p<0.05

Table 2 shows the difference in mean of pre SPADI among three groups was not statistically significant. But the difference in mean of post SPADI among three groups were statistically significant.

Table 2 Mean, standard deviation and p value of Pre-Post SPADI among Group A , Group B and Group C.

	Pre SPADI			Post SPADI		
	Mean ±SD	F	P	Mean ±SD	F	P
Group A	72.07 ±5.52	0.43	0.64	45.46 ±3.52	12.10	0.00
Group B	72.77 ±3.85			44.07 ±3.36		
Group C	70.60 ±6.00			36.53 ±5.78		

Table 3 shows the comparison of scores of active ROM in terms of flexion, abduction, external rotation & internal rotation respectively among Group-A, Group-B & Group-C before and after 3 weeks. It was found that before the start of 3 weeks treatment programme to the subjects of three groups, there existed no statistical difference in the scores of active ROM. However after 3 weeks statistically significant difference in the scores of active ROM in all the groups but a greater improvement was observed in Group-C as compared to Groups- A & B respectively.

Table 3: Mean, standard deviation and p value of Pre-Post Active ROM comparison among Group A, Group B and Group C.

Movements		PRE-ROM			POST-ROM		
		A	B	C	A	B	C
Flexion	Mean ±SD	100.60±6.93	98.80±7.17	99.30±7.60	102.30±6.71	102.90±6.93	110.60±7.01
	F value		0.16			4.51	
	P value		0.84			0.02	
Abduction	Mean ±SD	98.40±5.40	98.50±6.02	96.50±6.78	101.80±5.51	101.20±6.05	109.50±8.68
	F value		0.34			4.51	
	P value		0.71			0.02	
External rotation	Mean ±SD	19.20±3.67	21.80±2.78	21.00±1.49	23.60±4.16	29.70±5.16	32.40±3.92
	F value		2.26			10.25	
	P value		0.12			0	
Internal rotation	Mean ±SD	27.30±6.80	31.20±7.16	34.90±7.52	29.90±6.59	31.70±4.11	39.40±9.09
	F value		2.81			5.34	
	P value		0.07			0.01	

Table 4 Mean, standard deviation and p value of Pre-Post Passive ROM among Group A, Group B and Group C.

Movements		PRE-ROM			POST-ROM		
		A	B	C	A	B	C
Flexion	Mean ±SD	100.90±6.59	98.90±7.37	99.80±7.74	108.20±4.46	108.80±5.18	114.60±5.58
	F value		0.19			4.8	
	P value		0.82			0.01	
Abduction	Mean ±SD	103.40±7.09	105.50±7.50	99.90±7.66	106.50±6.11	106.60±7.53	114.40±6.73
	F value		1.45			4.41	
	P value		0.25			0.02	
External rotation	Mean ±SD	22.70±3.88	27.10±4.77	26.10±5.25	24.80±3.64	28.40±4.37	
	F value		2.43			10.63	
	P value		0.1			0	
Internal rotation	Mean ±SD	34.50±6.31	40.60±7.58	33.60±8.15	37.30±6.30	40.80±7.54	47.10±1.19
	F value		2.95			7.54	
	P value			0.06		0	

Table 4 shows the comparison of scores of passive ROM in terms of flexion, abduction, external rotation & internal rotation respectively among Group-A, Group-B & Group-C before and after 3 weeks. It was found that before the start of 3 weeks treatment programme to the subjects of three groups there was no statistical difference in the scores of passive ROM. However after 3 weeks statistical significant differences in the scores of passive ROM in all the groups were recorded but a greater improvement was observed in Group-C as compared to Groups- A & B respectively. According to Tukey's, multiple comparisons, it was revealed that there is no significant difference found among Group A, Group B and Group C in terms of pre active & passive ROM respectively.

Post Hoc Analysis for Active Flexion ROM: There exists no significant difference, when Group A was compared with Group B (p value= 0.979), but there was significant difference observed in Group C compared with Group A (p value= 0.031) and Group and Group B compared with Group C (p value=0.048) in terms of post active flexion ROM.

Post Hoc Analysis for Active Abduction ROM: There exists no significant difference, when Group A was compared with Group B (p value=0.979), but there was significant difference, when Group C was compared with Group A (p value= 0.048) and Group B was compared with Group C (p value=0.031) in terms of post active abduction ROM.

Post Hoc Analysis for Active External Rotation ROM: There exists no significant difference in Group B when compared with group C (p value=0.377), but there was a significant difference in Group A compared with Group B (p value=0.013) and Group C compared with Group A (p value= 0.000) in terms of post active external ROM.

Post Hoc Analysis for Active Internal Rotation ROM: There exists no significant difference in Group A compared with Group B (p value=0.830), but there was a significant difference, when Group C

compared with Group A (p value= 0.013) and Group B compared with Group C (p value=0.049) in terms of post active external ROM.

Post Hoc Analysis for Passive Flexion ROM: There exists no significant difference in Group A compared with Group B (p value=0.963), but there was a significant difference, when Group A compared with Group C (p value= 0.024) and Group B compared with Group C (p value=0.043) in terms of passive flexion ROM.

Post Hoc Analysis for Passive Abduction ROM: There exists no significant difference in Group A compared with Group B (p value=0.999), but there was a significant difference, when Group C compared with Group A (p value= 0.039) and Group C compared with Group B (p value=0.042) in terms of passive abduction ROM.

Post Hoc Analysis for Passive External Rotation ROM: There exists no significant difference in Group A when compared with Group B (p value=0.226), but there was a significant difference, when Group C compared with Group A (p value= 0.000) and Group B compared with Group C (p value=0.021) in terms of passive External Rotation ROM.

Post Hoc Analysis for Passive Internal Rotation ROM: There exists no significant difference in Group A when compared with Group B (p value=0.371), but there was a significant difference, when Group C compared with Group A (p value= 0.002) and Group B compared with Group C (p value=0.052), in terms of passive Internal Rotation ROM.

Post Hoc Analysis for SPADI: According to Tukey's, multiple comparisons, it was revealed that there is no significant difference found among Group A, Group B and Group C in terms of pre SPADI. However there exists no significant difference in Group A when compared with Group B (p value=0.760), but there was a significant difference, when Group C compared with Group A (p value= 0.000) and Group B compared with Group C (p value=0.002), in terms of Post SPADI.

Discussion

The results of the present study indicated that subjects in all the three groups had shown significant improvements in the flexion, abduction, external and internal rotation ranges of motion respectively and there is decrease in shoulder disability as measured by SPADI. However, comparison among three groups, reveal that there is minimal improvement in end range mobilization group in terms of range of motion and shoulder disability, mobilization with movement group and combined intervention group. So, alternative hypothesis is accepted.

Comparing the effectiveness of the above treatment strategies in subjects with unilateral frozen shoulder, Group C (ERM+MWM) was observed to be more effective in increasing mobility and functional ability (Tables 3, 4). These results support the findings of previous studies *(Yang et al, 2007; Mulligan, 2003; Vermeulen et al, 2006; Teys et al, 2008; Kachingwe et al, 2008; Kumar et al, 2012)* showing improvement after mobilization in a frozen shoulder.

To regain the normal extensibility of the shoulder capsule and tight soft tissues, passive stretching of the shoulder capsule and soft tissues by means of mobilization techniques has been recommended, but limited data supporting the use of these techniques are available *(Vermeulen et al, 2000; Diercks and Stevens, 2004).* Mobilization techniques improve the normal extensibility of the shoulder capsule and stretch the tightened soft tissues to induce beneficial effects *(Yang et al, 2007).* The results of the present study support this promise and indicate that the most beneficial effects can be achieved with combination of ERM and MWM rather than separate one.

The three groups had equal number of subjects and there were no significant differences with respect to their gender distribution, age which could have altered the results of the study (Table 1).

Bialosky et al (2009) suggested that manual therapy (MT) is effective in the treatment of musculoskeletal pain. They proposed the mechanism accounts for the complex interactions of both the peripheral and central nervous system which comprise the pain experience. Specific joint mobilization techniques are believed to selectively stress certain parts of the joint capsule *(Terry, 1991).* Joint mobilization techniques are assumed to induce neurophysiologic effect which is based upon the stimulation of the peripheral mechanoreceptors and inhibition of nociceptors *(Mangus et al, 2002).* The biomechanical effect manifests itself when forces are directed towards resistance but within the limit of subjects tolerance. The mechanical changes may include breaking up adhesions, realigning of collagen or increasing fiber glide when specific movement stress the specific part of the capsular tissue *(Donatelli and Wooden, 2004).* Mobilization techniques are supposed to increase or maintain joint mobility by inducing rheological changes in synovial fluid, cartilage matrix and increased synovial turnover time *(Noel et al, 2000).*

Maitland's mobilization mainly consists of rhythmic oscillatory movements which stimulate the type-2 dynamic mechanoreceptors and by this way can inhibit the type-4 nociceptive receptors and also has an effect on circulatory perfusion. Mobilization has an effect on fluid flow as blood flow in the vessels supplying the nerve fibres and synovial fluid flow surrounding the avascular articular cartilage. Mobilization causes a reversal of the ischemia, oedema, and inflammation cycle and reduces joint effusion and relieves pain by reducing the pressure over the nerve endings *(Maitland, 1983).*

Mobilization with intense capsular stretching causes tissue remodeling refers to a physical rearrangement of the connective tissue extracellular matrix (fibers, crosslinks, and ground substance) and collagenous tissues respond to increased tensile loading by increasing the synthesis of collagen and other extracellular components *(Mueller and Maluf, 2002).*

Lin et al (2008) had found the reduction in GH joint stiffness and increase in passive abduction range of motion, immediately after end-range mobilization of the shoulder joint that is

consistent with the findings obtained in the present study (Table 4). The use of intensive mobilization techniques may help to decrease the risk of further stiffness or joint contracture progression in patients with adhesive capsulitis.

The result of the present study (Table 3, 4) are consistent with the finding obtained in the study conducted by *Wadsworth et al (1986)* demonstrated that, passive oscillatory movements are effective to reduce pain and increase in all the motions (except medial rotation in the control group) significantly in the frozen shoulder patients because of neuromodulation effect on the mechanoreceptors within the joints *(Barak, 1985)*.

Many authors and clinicians advocated joint mobilization for pain reduction and improved ROM *(Vermeulen et al, 2000; Vermeulen et al, 2006). Johnson et al (2007)* who found significant improvement in external rotation motion in patients with frozen shoulder after performing posterior glide mobilizations sustained for 1 minute at end range of abduction and external rotation by promoting elongation of shortened fibrotic soft tissues. These findings support the results obtained in the present study (Table 3, 4).

Vermeulen et al (2000) demonstrated that, with End range mobilization techniques (EMTs) there is increases in joint capacity and glenohumeral mobility after 3 months of treatment. He reported significant improvement in active and passive motion, pain and joint volume & the results coincide with the present study (Table 3, 4).

The findings obtained by *Teys et al (2008)* using the Mulligan's mobilization with movement(MWM) in the plane of scapula in the restricted shoulder results in significant improved ROM and Pressure pain threshold (PPT) are consistent with the findings obtained in the present study (Table 3, 4). Improved ROM by Mulligan's movement with mobilization is attributed to the mechanisms underlying it as described by *Wright et al (1995)*, that the mechanism responsible for MWM treatment effects may feasibly involve changes in the joint, muscle, pain and motor control systems as it produce an immediate relief in pain and improve ROM respectively.

Vicenzino et al (2007) reports espousing clinically beneficial effects of Mulligan's mobilization-with-movement (MWM) treatment techniques by substantial pain reduction accompanied by improved function in shoulder disorders by reducing positional faults at joints (subluxations). The evidence from the pain science studies that have attempted to characterize the hypoalgesic effect has indicated that it may be non-opoid in nature as well as exhibiting features that are complex and widely distributed to other systems, such as the motor and sympathetic nervous systems.

Kachingwe et al (2008) found, there was significant increase in active ROM and decrease in pain, in patients with Shoulder dysfunction by using MWM techniques as described by *Mulligan (1999)*. Passive movement produced by manual techniques resulted in pain reduction through activation of mechanoreceptors inhibiting nociceptive stimuli through the gate-control mechanism or through facilitation of

synovial fluid nutrition *(Threlkeld, 1992)*. An additional explanation given that why MWM was better in decreasing pain and improving function is that, MWM technique has the additional benefit which may engage additional proprioceptive tissues, such as the golgi tendon organs activated by tendon stretch and restored the normal glenohumeral arthrokinematics and resulted in capsular stretching *(Kachingwe et al, 2008)*.

In the post hoc analysis, using Tukey's method it was found that, both End range mobilization and Movement with mobilization techniques increases both active and passive ROM and reduces disability significantly in 20 Frozen shoulder patients after 3 weeks intervention, but the more statistical significant result was found with combined intervention of ERM and MWM techniques in both active and passive ROM and SPADI scores in 10 frozen shoulder patients after 3 weeks intervention.

Conclusion

It was concluded that the combination manual therapy (ERM+MWM) should be incorporated in the treatment protocol of frozen shoulder patients to achieve better gain in the ROM & SPADI scores.

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Mechanical Power of Leg Extensor Muscles in Male Handball Players

Singh[1], Baljinder, Kumar[2], Ashok & Ranga[3] M. D.
[1]PhD Research Scholar, Department of Sports Science, Punjabi University Patiala, Punjab,
E-mail: bali007@rediffmail.com
[2]Assistant Professor, Department of Sports Science, Punjabi University Patiala, Punjab
[3]Scientific Officer, Biomechanics Department, SAI NS NIS Patiala, Punjab

Abstract

The present study was conducted on eighteen male Handball players (age: 15.83 ± 0.62 years) comprising of players training under the guidance of Punjab State coaches in Patiala (India). The main objective of the study was to find the status of mechanical power variables of leg extensor muscles in male handball players and to find the relationship between them. The experimental protocol developed by *Bosco et al (1983), Mcguigan et al (2006)* were used to measure the mechanical power variables of leg extensor muscles in male handball players. For the purpose of statistical analysis of the data, Karl Pearson's coefficient of correlation was calculated with the help of SPSS version 9.0. The results of this study indicate that there was a highly significant correlation exists between the squat jump flight time, squat jump height, countermovement jump height, countermovement flight time, Eccentric Utilization Ratio (EUR), Elasticity Index (EI) and peak power (0-15sec), peak power (45-60sec) and Mean Power (0-60sec).

Key words: Mechanical Power, Vertical jump test, Leg Extensor Muscles, Muscular Power.

Introduction

Vertical jump ability is of considerable importance in numerous handball events. Coaches and trainers are greatly interested in developing training techniques designed to improve power performance of the legs and vertical jump ability *(Blattner, 1980)*. There is no doubt that high-level handball practice and the vertical jump is very important for the shooters or defence actions. During the last few years, performing plyometric exercises in general *(Wilt, 1978)* and drop jumps *(Komi and Bosco, 1978)*, also called depth jumps *(Wilt, 1978)*, in particular, has become very popular in training. Increases in vertical jumping performance after drop jump programmes have been reported in several studies *(Blattner and Noble, 1979; Steben and Steben, 1981; Clutch et al., 1983)*. Strength is the ability to produce maximal force, which is considered a basic motor ability and contributes to high performance in most physical activities and sports for prevention of injury *(Coyle et al, 1981, Pangrazi, 1999)*. Numerous studies of young athletes indicate that specific training in track and field, gymnastics, swimming, soccer, basketball improve vertical jumping performance, explosive strength of upper and lower limbs. Soccer, *(Gorostiaga et al, 2002)*, basketball *(Foley 1988, Klizning, 1991)*, volleyball *(Mills et al. 2005)*, and tennis training *(Huff, 1972, Liemohn, 1983)* improve the explosive strength of lower

limbs and consequently vertical jumping performance. Very few studies have examined the effect of a handball training program on fitness characteristic in young athletes. Handball is a very dynamic team sport, requiring continuous alterations of intensity and kinetic actions and it is characterized by a great number of side movements, jumps, throws, and body contacts all of which strictly depend on muscular strength. Previous studies have reported that the high performance in many sporting endeavors is characterized by the ability to display high amounts of muscular power. Power is the product of muscular force and velocity or as an instantaneous value during a given movement. The latter, often referred to as peak power (PP), is typically associated with explosive movements such as sprinting, jumping and may be an important variable associated with success in a given discipline. The measurement of Peak Power by strength and conditioning-coaches is an important consideration in the training process. Changes in PP throughout the annual plan may be indicative of training status or adaptation to the workload and could be used to plan or adjust the training program based on the athlete's performance. The knowledge of mechanical power components of lower extremities of athletes of selected game disciplines can be of great interest for coaches and sport scientists to optimize talent selection for sport disciplines where jumping is an integral part of game. Therefore, the aim of the present study was to find the status of mechanical power of leg extensor muscle in male handball players.

Materials & Methods

Eighteen male Handball players with mean age of 15.83 ± 0.62 years; height of 176.61 ± 5.05 cm; body mass of 59.00 ± 6.53 kg) were briefed about the purpose of the study and the experimental protocol *(Bosco et al., 1983, Mcguigan et al., 2006)* to be administered before starting the study on players undergoing training under the guidance of Punjab State coaches in Patiala (India). All the risks involved were also explained to each player and voluntary consent was taken from them. Each volunteer was first subjected to physical examination that included measurements of corporal data like date of birth, age, training age, height, body mass and sports discipline. The participants performed an adaptation process previous to the vertical jump test so that error could be minimized.

The vertical jump test measurement system consisted of a portable hand-held computer unit connected to a contact mat (Swift Performance, New South Wales, Australia). It has been previously reported that the system is reliable compared with a force platform ***(****Cronin et al, 2001****).***

Vertical Jump Tests: Three jumps Squat jump (SJ), Counter Movement Jump (CMJ) and Continuous Vertical Jump Test for 60 seconds (CVJT) were administered according to the experimental protocol *(Bosco et al, 1983, Mcguigan et al, 2006).*

Explosive strength and endurance variables: In this study, Eccentric Utilization Ratio (EUR) was calculated from vertical jump height (CMJ/SJ) or peak power (CMJ/SJ) by using *Sayers et al (1999)* peak power formula. Muscle Elasticity index was calculated from the jump height reached in CMJ and SJ Jumps

(CMJ – SJ *100 / SJ*) (Sayers et al, 1999)*. The explosive strength and endurance variables were power peak (PP), mean power (MP) and fatigue index (FI). Concerning the CVJT (Continuous Vertical Jump Test), the PP was estimated by the mechanical power produced in the first 15 seconds of a 60-second work. The MP was estimated by the amount of work during a 60-second continuous effort. For PP and MP, the results were expressed in watts/kg (W/kg), according to the equation described by *Bosco et al (1983)*. The fatigue Index (FI) was calculated as the difference between the power peak (work produced in the first 15 seconds) and the mean power generated in the last 15 seconds of a continuous vertical jump work of 60 seconds relative to first 15 seconds peak power. The result was expressed in percentage (%).

Test procedure and data collection

The participants were told to perform a 15-minute routine warm-up before performing the tests through stretching, running, coordination exercises and consecutive jumps (two sets of five vertical jumps). Three squat jumps (SJ) and three counter movement jumps (CMJ) were performed in random order on a jump mat connected to an electronic timer without the aid of an arm swing; this was standardized by having participants hold their hands on their hips. Two minutes rest period between attempts was established. The SJ involved the subject flexing the knee to approximately 90 degree maintaining the position for 3 seconds, and then jumping on the command ‘‘go.’’ The CMJ was performed under the same conditions but involved flexion of the knee followed immediately by extension of the legs. Test was executed following the original protocol for both jumps *(Sayers et al., 1999)*. On the next day, again the participants performed a 15-minute routine warm-up before the tests through stretching, running, coordination exercises and consecutive jumps (two sets of five vertical jumps).The participants were told to perform the continuous vertical jump Test (CVJT) during a work performed at maximal effort, with no pauses between jumps for 60 seconds. The subjects were told to keep chest in vertical position, with no excessive advance to avoid influence in the results; as well as to keep knees in extension during the flight, remaining with hands around waist. The participants were given stimulus to jump the highest as possible during the tests.

Statistical Analysis: Mean and standard deviation for all the attributes age, height, body mass and biomechanical transients related to vertical jumps were calculated. Karl Pearson’s coefficient of correlation was calculated with the help of SPSS version 9.0 software to find the relationship between the biomechanical transients. The level of significance was $p<0.05$.

Results & Discussion

Table 1: Mean±SD of Age, height & body mass of male Handball players

Game	N	Age, years	Height, cm	Mass, kg
Handball	**18**	**15.83 ±0.62**	**176.61 ±5.05**	**59.00 ±6.53**

Table 2: Mean±SD of Mechanical power variables of the three vertical jump tests of male Handball players

Squat Jump (SJ)		Counter Movement Jump (CMJ)		EUR	EI	Continuous Vertical Jump test 60 seconds (CVJT) Mechanical Power (w/kg)			
JH, cm	Flight Time, Sec	JH, cm	Flight Time, Sec			PP (0-15 sec)	PP (45-60 sec)	MP (0-60 sec)	FI
26.06	0.462	29.17	0.487	1.09	12.84	15.55	11.72	13.47	22.90
±3.96	±0.033	±3.13	±0.029	±0.06	±9.01	±3.00	±2.60	±2.38	±17.27

JH - Jump Height; FT-Flight Time; EUR-Eccentric Utilization Ratio; EI-Elasticity Index; MP- Mechanical Power; PP-Power Peak; MP- Mean Power; FI - Fatigue Index

Table 3: Correlation Matrix for various mechanical power variables of the three vertical jump tests of male Handball players

	AGE	HEIGHT	WEIGHT	SJ HEIGHT	SJFT	CMJJH	CMJFT	EUR	EI	PP15	PP45	MP60
HEIGHT	.392	-										
WEIGHT	.553*	.297	-									
SJHEIGHT	.340	.489*	.209	-								
SJFT	.322	.469*	.204	.990**	-							
CMJJH	.350	.525*	.339	.877**	.871**	-						
CMJFT	.355	.475*	.365	.872**	.877**	.990**	-					
EUR	-.291	-.203	-.137	-.694**	-.682**	-.283	-.296	-				
EI	-.128	-.206	.122	-.694**	-.689**	-.265	-.271	.957**	-			
PP15	-.052	-.269	-.197	.339	.380	.338	.348	-.143	-.191	-		
PP45	.333	-.177	-.001	.323	.263	.134	.124	-.468*	-.411	.330	-	
MP60	.205	-.282	-.117	.366	.355	.177	.189	-.474*	-.459	.729**	.826**	-
FI	-.317	-.045	-.120	.053	.138	.241	.260	.294	.211	.542*	-.606**	-.138

***significant at the 0.05 level; ** significant at the 0.01 level**

JH - Jump Height; FT-Flight Time; EUR-Eccentric Utilization Ratio; EI-Elasticity Index; MP- Mechanical Power; PP-Power Peak; MP- Mean Power; FI - Fatigue Index

The results of present study demonstrate a close relationship between the various mechanical power variables of the three vertical jump tests (Squat jump, Counter movement jump and Continuous vertical jump test for 60 seconds) of male handball players. Height has shown significant correlation with squat jump height, squat jump flight time, counter-movement jump height and counter-movement jump flight time at 0.05 level of significance. Highly significant correlation was observed between the squat jump height and squat jump flight time, counter-movement jump height and counter-movement jump flight time at 0.01 level of significance. Highly significant negative correlation was observed between the squat jump flight time, squat jump height and Eccentric Utilization Ratio (EUR), Elasticity Index (EI) at 0.01 level of significance. Highly significant correlation was observed between the Eccentric Utilization Ratio (EUR) and Elasticity Index (EI) at 0.01 level of significance. High significant correlation was observed between the Peak Power (0-15sec) and Mean Power (0-60sec) at 0.01 level of significance. Significant correlation was observed between the Power (0-15sec) and Fatigue Index (FI) at 0.05 level of significance. Highly significant correlation

was observed between the Peak Power (45-60sec) and Mean Power (0-60sec) at 0.01 level of significance. Highly significant negative correlation was observed between Peak Power (45-60sec) and Fatigue Index (FI) at 0.01 level of significance.

Francisco et al., (2010) observed that the average squat jump height 15.8±4.2cm, flight time 357±44.4msec, countermovement jump height 16.9±4.8cm, flight time 369.0±49.9msec and elasticity index 7.1±3.2 for male table tennis players (age 11.32±1.82 years). Whereas in the present study the average value of squat jump height 26.06±3.96cm, flight time 462±33msec, countermovement jump height 29.17±3.13cm, flight time 487±29msec and elasticity index 12.84±9.01 was observed. The Eccentric Utilization Ration (EUR) has been suggested as a useful indicator of power performance in athletes. *McGuigan et al., (2006)* observed the average value of Eccentric Utilization Ration (EUR) 1.03±0.20 for male soccer players, 1.00 ±0.17 for softball male players, 1.03±0.20 for football male players & 1.01±0.20 for rugby male players. While in the present study the average value of EUR 1.09±0.06 was observed. In the present study the average Mean Power (0-60sec) recorded during the vertical jump test for handball players (age 15.83±0.62 years) was 13.47±2.38w/kg whereas *Bosco et al. (1983)* found that average Mean Power (0-60sec) for school going Boys (age 17.3±0.8 years) was 22.2±1.8 w/kg. *Jefferson et al., (2007)* found the average Peak Power (0-15sec) 27.76±3.78w/kg, Mean Power (0-60sec) 19.56±2.59w/kg & fatique index (%) (FI) 48.60±7.01 for male volleyball players (age 19.01±1.36 years). In another study by *Jefferson et al., (2006)* of the Intermittent vertical jump tests (IVJT) observed the average Peak Power (0-15sec) 24.68±2.70w/kg, Mean Power (0-60sec) 18.79±2.23w/kg & fatique index (%) 57.50±9.51 for the male handball and basketball players (age of handball players 25.74±4.71years & basketball players 18.60±0.77years). Whereas the in the present study the value of average Peak Power (0-15sec) 15.55±3.00w/kg, Peak Power (45-60sec) 11.72±2.60w/kg, Mean Power (0-60sec) 13.47±2.38w/kg & fatique index (%) 22.90±17.27 was observed.

Conclusion: In conclusion, based on the above considerations, the reported jumping test might offer the possibility of evaluating the mechanical power of the leg extensor muscles during explosive stretch-shortening type exercises, which involve both metabolic and mechanical behaviour of skeletal muscles. The measurement of Peak Power by strength and conditioning-coaches is an important consideration in the training process. Changes in Peak Power throughout the annual plan may be indicative of training status or adaptation to the workload and could be used to plan or adjust the training program based on the athlete's performance.

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Effect of Proprioceptive Exercise Training on Joint Reposition Sense and Balance of Athletes with Knee Injury

Gajanana Prabhu, B.

Assistant Professor, Department of P. G. Studies and Research in Physical Education,
Kuvempu University, Shimoga 577451 Karnataka,
Phone: 09845311458; email prabhuji888@gmail.com

Abstract

The purpose of the study was to find the effects of proprioceptive exercise training on joint reposition sense and balance in athletes with knee joint injury. The subjects selected for the purpose of the study were five male post graduate students between the age group of 23 to 29 years pursuing their M. P. Ed. during the academic year 2012-13. The subjects suffered from knee injury during sporting endeavors at intercollegiate and inter University levels. All the subjects were recovering from sprained ligament of right leg that occurred within a span of one year. Tests included were Weight-Bearing Joint Reposition Sense; Non-Weight-Bearing Joint Reposition Sense; Romberg's test- Bilateral; and Romberg's test- Unilateral. The experimental design selected for the present investigation was single group pre test- post test design. The selected tests were administered to the subjects twice during pre test and post test situations. Mean, Standard Deviation 't' tests were included to statistically treat the data. The pre and post test scores of subjects on joint reposition sense test with and without weight bearing, and bilateral Romberg's test for balance showed significant differences. The unilateral Romberg's test for balance does not show significant difference. It was concluded that the proprioceptive exercise training during post injury rehabilitation has beneficial effects on joint position sense and balance of athletes with knee injury.

KEY WORDS: Knee injury, Sprain, Rehabilitation, Proprioceptors, Proprioceptive exercises.

Introduction

Many injuries are season-ending or even career- ending. In these cases it is particularly important to be realistic with the athlete in setting the goals for recovery and return. Determining when to allow an athlete to resume training and competition following an injury is one of the most crucial and difficult functions of any physical education personnel. A thorough understanding of the mechanics, physiology, patho-anatomy, and healing principles in injured tissues is essential to making appropriate decisions regarding return to play.

One of the major contributions the trainer can make to the welfare of the athlete is in the area of rehabilitation. The overall goal of the treatment and rehabilitation programme is to return the athlete to his or her desired level of participation as soon and as safely as possible. The type of rehabilitation program that is prescribed frequently determines what level of athletic participation will be possible in the future. Rehabilitation restores full flexibility,

strength, endurance and motion to an injured athlete.

Returning the injured athlete to competition usually involves a step-wise progression through a rehabilitative process, with the end goal being resumption of participation at the pre injury level of play. It is also important to prevent further injury by allowing adequate healing and providing appropriate exercise during recovery.

As the injury resolves, specific attention must be paid to strengthening both the injured tissues and the associated dynamic supporting structures. Often tissues that are not involved in the initial injury will be weakened through immobilization or reflex inhibition. Functional rehabilitation is aimed at neuromuscular retraining, strengthening of injured and associated supporting tissues, and restoration of normal joint motion. This stage of treatment is primarily accomplished through self-directed exercise with supervision from the trainer and therapist.

Exercise is a vital part of rehabilitation process for most of the sports related injuries. As popularly believed the athlete cannot resume training once his course of treatment is completed. Returning to pre-injury state is most essential to avoid recurrent injury and ensure high sports performance. Once the pain has subsided athlete's flexibility and strengthening goals have to be achieved through systematic training.

Following injury to joints and ligaments the receptors are also damaged, which means the information that is usually sent to the brain is impaired. As a consequence the joint feels odd or just doesn't feel right. The loss of position sense puts the joint at further risk of injury because of the loss of stability, postural control and functional capacity. The therapeutic values of exercise come into effect at this stage of rehabilitation during injury to muscle, tendon or ligament. The rehabilitation programme should essentially include proprioceptive training.

Proprioception is the body's ability to transmit a sense of position, analyze that information and react (consciously or unconsciously) to the stimulation with the proper movement *(Houglum, 2001)*. Proprioception includes balance, coordination and agility because the body's proprioceptors control all these factors. It describes the body's ability to react appropriately to external forces.

No single receptor provides all the information needed by the central nervous system to evaluate posture and body position. Input from muscle and joint receptors, vestibular apparatus, and the eyes are synthesized for total body position information *(Stone et. al., 1994)*. Proprioceptive feedback reaches the central nervous system from receptors located in muscles and joints, vestibular apparatus in the inner ear, and the eyes. Muscle and joint receptors are stimulated by movements of the musculoskeletal system. The vestibular apparatus provides information on whole body position and is stimulated when upright body posture changes. The eyes help orient the head and body with respect to the environment. Since athletes must attend to sport-related stimuli when performing, they rely on information from muscle and joint receptors and the vestibular apparatus to

balance and maintain body position. When visual stimuli are removed or are distracting, damaged muscle and joint receptors are reeducated to provide accurate positional information to the central nervous system.

Raibeiro and Oliveira (2012) indicate that joint position sense and muscle function is still impaired after an accelerated rehabilitation protocol for anterior cruciate ligament reconstruction surgery suggesting that these individuals are still predisposed to further muscle or proprioceptive related knee injury. Exercise is an imperative part of the rehabilitation process for most sports injuries. Attaining pre-injury flexibility and strength is invariably an essential part of rehabilitation. Rehabilitation programme must essentially include proprioceptive training due to the impairment of such capabilities.

A number of studies have shown that proprioception training can reduce the risk of injuries in sports, but the mechanism is still not clearly understood. Proprioceptive exercise could be a better choice of treatment from physiotherapy point of view in the management of osteoarthritis of knee *(Mondam & Prakash, 2012)*. The results of the study by *Panics et al (2013)* show that the proprioception training improves the joint position sense in elite female handball players. This may explain the effect of neuromuscular training in reducing the injury rate.

The present study focuses on the importance of exercise for proprioception in the perspective of post injury rehabilitation in sports. Injuries to a joint, specifically ligament sprains, have the potential to diminish proprioception and subsequently result in recurrent injury. Proprioceptive exercises provides training to brain, nerves and muscles to communicate better to correctly identify where the body is and how it is moving. The purpose of the study was to find the effects of proprioceptive exercise training on joint reposition sense and balance in athletes with knee joint injury.

Materials & Methods

Selection of subjects: The subjects selected for the purpose of the study were five male post graduate students pursuing their M. P. Ed. during the academic year 2012-13. The subjects selected were sufferers of knee injury during sporting endeavors at intercollegiate and inter University levels. All the subjects were recovering from injury that occurred within a span of one year and their age ranged between 23 to 29 years. The scanning reports of the subjects revealed the fact that all the subjects were afflicted with sprained ligament of right leg.

Selection of test items: The present study included testing of joint position sense and balance of subjects during pre and post test situations. All together four tests were conducted in order to assess joint position sense and balance of subjects. These were:

- Test 1: *Weight-Bearing Joint Reposition Sense (Drouin et al, 2003)*

The weight-bearing condition measured participants' ability to actively reproduce a target angle of 30° using

methods previously described.' While in single-leg stance on a 6-in-high box, each subject was instructed to slowly squat. The researcher instructed the subject to stop and pause for 15 seconds when the knee-joint angle measured 30°. Next, the subject returned to a standing position and waited for 15 seconds. The subject was then instructed to reproduce the target angle for that trial as accurately as possible. Each subject maintained balance by leaning backward against the wall. The non testing leg remained fully extended and non-weight-bearing off the edge of the box during the entire test. Between trials, each subject walked 20 ft to eliminate any proprioceptive memory of the test.

- Test 2: *Non-Weight-Bearing Joint Reposition Sense (Drouin et al, 2003)*

To assess JRS in the non-weight-bearing condition, each subject was seated on a chair reclined to 55°. The joint line of the dominant leg was aligned 10 cm from the edge of the seat. While seated with the test leg fully extended, the subject was instructed to slowly flex the knee. The researcher instructed the participant to stop when the knee-joint angle measured 30° and to hold the position for 15 seconds. The subject then returned the test leg to the fully extended position and paused for 15 seconds. Next, the subject was instructed to reproduce the target angle of that trial as accurately as possible. Between trials the subject performed 5 repetitions of knee flexion and extension to eliminate any proprioceptive memory.

- Test 3: *Romberg's test- Bilateral (wikipedia.org)*

It is a test used by clinicians in a neurological examination and used to investigate the cause of loss of motor coordination. The examination is based on the premise that a person requires at least two of the three following senses to maintain balanced while standing: Proprioception (the ability to know one's body in space); Vestibular function (the ability to know one's head position in space); and Vision (which can be used to monitor [and adjust for] changes in body position). The subject was asked to stand erect with feet together and eyes closed. The investigator stood close by as a precaution in order to stop the subject from falling over and hurting himself. The movement of the body was watched in relation to a perpendicular object behind the subject (corner of the room). A positive sign was noted when a swaying, sometimes irregular swaying and even toppling over occurred. The essential feature is that the subject becomes more unsteady with eyes closed.

The essential features of the test are as follows:

- The subject stands with feet together, eyes open and hands by the sides.
- The subject closes the eyes while the examiner observes for a full minute.

Because the examiner is trying to elicit whether the patient falls when the eyes are closed, it is advisable to stand ready to catch the falling patient. Romberg's test is positive if the patient sways or falls while the patient's eyes are closed.

- Test 4: *Romberg's test- Unilateral (Sekir & Gur, 2005)*

During 'eyes open' balance tests, subjects looked straight ahead at a cross marked at approximately eye level on the wall 2-m away. For unilateral Romberg test, subjects stood on the test side limb with their stance foot centered on the floor and with their knee in slight flexion. They were instructed to lift the limb that was not being tested by bending the knee, and holding it at approximately 90° of knee flexion. Once the subjects were in this position, and stated that they were ready, data collection was initiated. For each test balance measurements were performed for a maximum 30 seconds (provided subjects did not move their body or make contact with the ground). Subjects were asked to stand unsupported with their arms at their side. The subjects performed this test without shoes and socks to negate any extraneous skin sensation from clothing touching the foot area. The outcome measure (time in seconds) used for the balance assessment was averaged over the 2 trials, for each test situation.

The experimental design: The experimental design selected for the present investigation was single group pre test- post test design. This design exhibits minimal control. There is somewhat more structure, there is a single selected group under observation, with a careful measurement being done before applying the experimental treatment and then measuring after. The selected tests were administered to the subjects twice during pre test and post test situations.

The treatment: Treatment was given to all the subjects by a planned model of proprioceptive exercises prepared with the help of experts and reviews gone through. The treatment in the form of cost effective and simple exercises done on the floor as well as on the balance (wobble) board was accomplished three times a week up to eight weeks duration. List of exercises is provided in table 1.

Statistical techniques: In order to make inferences on the effectiveness of treatment given for eight weeks various statistical techniques were employed. The raw data on pre test and post test was subjected to descriptive statistics line mean and standard deviation. Further, in order to compare mean scores of various tests on pre and post tests- 't' test was employed.

Table 1: Description of proprioceptive exercises

Walk forward through 6 boxes (50cm x 50cm) on one-foot (in-in-out to right-in-in-out to left).	**Advanced one leg balance for 30 seconds**
Walk heel-to-toe along a 3m line marked on a medium-density polyfoam mat.	**Maximum forward backward leg swings with knee extended**
Stand on one leg with knee straight- raise leg forward & backward.	**Bicycle leg swings without resistance**
Stair case climbing- 3 steps	**Double leg balance on a wobble board Two leg Balance board exercises (with big balls as distracters)**
Stand with feet approximately shoulder width apart and extend arms out slightly forward and lower than the shoulder. Lift both heels off the floor and try to hold the position for 10 seconds. Followed by climbing a regular 3 steps staircase (17 cm high and 23 cm wide), -up and -down.	**One leg Balance board exercises (with big balls as distracters)**
	Two leg Balance board exercises (with slightly smaller balls as distracters)
	One leg Balance board exercises (with slightly smaller balls as distracters)
	Two leg Balance board exercises (with smaller balls as distracters)
Toe walking	**One leg Balance board exercises (with smaller balls as distracters)**
Heel walking	**Two leg Balance board exercises (with talking as distraction)**
Forward leg swings	**One leg Balance board exercises (with talking as distraction)**
Side ward leg swings	
One leg heel raise	
One leg squat	

Results & Discussion

The raw data on joint reposition sense test with and without weight bearing, unilateral and bilateral Romberg's test

during pre and post test were subjected to statistical treatment. The mean and standard deviation of tests are provided in table 2.

Table 2: Details on descriptive statistics of subjects on joint reposition and balance tests

Sl. No	Tests	Pre test	Post test
1	Joint reposition sense test- with weight bearing (in angles)	72±11.22	39.8±2.49
2	Joint reposition sense test- without weight bearing (in angles)	34±5.15	24.6±1.95
3	Bilateral Romberg's test (in seconds)	34.4±16.56	47.8±13.70
4	Unilateral Romberg's test (in seconds)	21.6±5.59	27.2±3.03

Table 2 depicts mean and standard deviation of joint reposition and balance scores. In order to find out the differences in mean scores and make inferences, the data was further treated with 't' test. Details are given in the following table 3.

Table 3: t-test results

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pre – Post test comparison of joint reposition sense test with weight bearing	32.20	8.928	3.993	21.115	43.285	8.065	4	0.001
Pre – Post test comparison of joint reposition sense test without weight bearing	9.40	4.879	2.182	3.343	15.458	4.308	4	0.013
Pre – Post test results of bilateral Romberg's test for balance	13.40	5.941	2.657	20.777	6.023	5.043	4	0.007
Pre – Post test results of unilateral Romberg's test for balance	5.60	7.635	3.415	15.081	3.881	1.640	4	0.176

Table 3 makes it very clear that the pre and post test scores of subjects on joint reposition sense test with and without weight bearing, and bilateral Romberg's test for balance shows significant difference. The obtained 't' ratio is 8.065, 4.308 and 5.043 respectively, which is higher than the tabulated 't' value (2.776) required for significant difference. Hence null hypothesis is rejected and it is affirmed that there is significant improvement in these aspects during post treatment testing.

Further, Table 3 makes it apparent that the pre and post test scores of subjects on unilateral Romberg's test for balance do not show significant difference. The obtained 't' ratio is 1.640 which is lower than the tabulated 't' value (2.776) required for significant difference.

On the basis of reviews gone through it was understood that the role of proprioceptive exercise training in knee injured athlete was poorly researched topic. An improvement in joint reposition sense with and without weight bearing; as well as bilateral and unilateral balance was expected through proprioceptive exercise training.

Joint reposition sense with weight bearing: Under the limitations of the study, significant improvement was

observed in joint reposition sense with weight bearing in sports persons with knee injury. The proprioceptive exercise training model selected in the present study can be useful in obtaining joint reposition sense with weight bearing in knee injured sportspersons.

The findings of the study conducted on the effects of a multi-station proprioceptive exercise program on functional capacity, perceived knee pain, and sensoriomotor function.by *Sekir & Gur (2005)* suggests that using a pure proprioceptive/balance exercise program it is possible to improve functional capacity, postural control and decrease perceived knee pain in patients with bilateral knee osteoarthrosis.

Joint reposition sense without weight bearing: Under the limitations of the study, significant improvement was observed in joint reposition sense without weight bearing in sports persons with knee injury. The proprioceptive exercise training model selected in the present study is also useful in obtaining joint reposition sense without weight bearing in knee injured sportspersons.

Knee joint position sense was assessed by active tests with active limb matching responses in supine lying and in unilateral weight bearing stance using repositioning of the whole limb whilst focusing on the knee, and in supine lying using repositioning confined to the knee. Active knee joint position sense assessments in unilateral weight bearing stance with eyes closed and hand support produced more accurate and reliable results than non weight bearing assessments in supine lying. Active non weight bearing knee joint position sense assessments involving knee repositioning were more reliable, but not more accurate than the non weight bearing assessments with limb repositioning *(Stillman & Mc Meeken, 2001)*.

Bilateral balance: Bilateral balance measured in terms of Romberg's balance test showed significant improvement in sports persons with knee injury in the present investigation.

Demirhan et al, (2005) investigated short-term clinical effects of kinesthesia and balance exercises in patients with knee osteoarthritis. Additive positive effects of kinesthesia and balance exercises in knee osteoarthritis have been demonstrated. Used in clinical applications, they should be able to increase the functional capacities of patients.

Maggo et al (2011) compared the effectiveness of proprioceptive exercises and strengthening exercises in treatment of osteoarthritis of knee in terms of pain and functional disability. The study between three groups comparing conventional treatment to strengthening and proprioceptive exercises suggest that combination of the two brings better relief to the subjects of knee OA in reducing pain and functional disability.

Unilateral balance: Unilateral balance measured in terms of Romberg's balance test did not show significant improvement in sports persons with knee injury in the present investigation. The reasons can be attributed to insufficient duration of

treatment or the selection of exercises in the present context.

Conclusion: Proprioceptive exercise training during post injury rehabilitation has beneficial effects on joint position sense and balance of athletes with knee injury. Favorable effects of proprioceptive exercises have to be clearly understood by coaches, trainers and physicians in avoiding recurrent injury to knee. It must become an imperative part of any rehabilitative program aiming at regaining functional performance of knee. This will aid in return of the athlete with pre injury state of knee functioning and self confidence.

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Comparative Analysis of Effectiveness of Conventional Proprioceptive Training and Multistation Proprioceptive Training on Vertical Jump Performance in Indian Basketball Players

Gaurav[1], S., Pooja[2], A., Shishir[3], N., Tanvi[4], A.

[1]Consultant Physiotherapist, Institute of Brain and Spine, Sunflag Hospital. Faridabad, Haryana
[2]Assistant professor, Manav Rachna International University. Faridabad,Haryana
[3]Assistant professor, Manav Rachna International Universit, Faridabad, Haryana
[4]Assistant professor, Santosh Medical College. Ghaziabad

Abstract

The purpose of the study is to investigate whether conventional (wobble board) proprioceptive training or multi-station proprioceptive training is an effective way to improve vertical jump performance. The research study included 30 basketball players divided into the two groups, Group A (n = 15) and Group B (n = 15). The group A underwent the wobble board proprioceptive training program lasting for four weeks. The group B was administered the multi-station proprioceptive training program lasting for four weeks. Both the training programs consisted of one-leg and double-leg static and dynamic balance drills. The demands and duration of those exercises increased progressively. The vertical jump height was estimated by Sergeant Jump Test at the beginning, after second week and at the end of the experiment. The results of this study indicate that Multi-station training showed greater improvements as compared to the conventional balance training and the results were significant at $p<0.01$. Multi-station training consisted of gradually progressive activities on exercise mats, wobble boards, mini trampoline, thera – band and walking on uneven surface while the conventional training consisted of training on wobble boards.

KEY WORDS: Proprioceptive Training, Multi-Station Proprioceptive Training, Wobble Boards, Thera – Band

Introduction

Sports today is becoming increasingly scientific and elite athletes rely as much on technique as on training. With the consequent raising of the bar and narrower winning margins, maximizing performance while avoiding injury requires continuous physiological monitoring of athletes during both training and competitions. According to *Matavulj et al (2001)*, importance of jumping performance in various kinesiologically related fields is caused by several reasons. First, jump height per se is important for success in different sport games and other athletic competitions. Second, different kinds of vertical jump served as a very popular model for studying various biomechanical and neuro-physiological phenomena. Finally, it is widely accepted that the jump height represents a good predictor of muscle power and, therefore, various kinds of vertical jumps have been often employed as standard tests of movement performance *Matavulj et al (2001)*.

Proprioception training, along with strength and flexibility training, is believed to be essential to the success of most rehabilitation programs (*Kristen et al, 1997)*. According to *Ya-Wen Liu, et al (1997),* proprioception can be defined as the conscious awareness of limb position and movement, and is a specialized variation of the sensory modality that encompasses the sensation of joint movement (kinesthesia) and joint position (joint position sense) *(Lephart et al. 1992)*. Proprioception is generally defined as the ability to assess a respective limb's position without the assistance of vision. Proprioception is governed by central and peripheral mechanisms that come mainly from muscular receptors, but also includes tendinous, articular and cutaneous receptors (*Ya-Wen Liu et al, 1997)*.

Team sport athletes, such as an American football lineman, a basketball centre, or rugby forward, require a balance of strength, power, and hypertrophy for success, and have different requirements to the specialist needs of athletes such as power lifters or bodybuilders. The increase in strength for vertical jump is therefore essential for an athlete playing basketball. History of different researches in this field of sport sciences have given their conclusion suggesting that individually different training improves strength but combination of different techniques such as trampoline training, thera-band, wobble board etc. Multi station Proprioceptive training can be incorporated for improving the vertical jump. Multi-station training provides differential grading and can be used to break monotony of conventional exercise. Proprioception training can also be used for prevention of recurrent injuries of lower limb. Multi-station exercise, a low frequency exercise, is easy to integrate into normal training routines.

Materials and Methods:

Thirty subjects who were regularly playing basketball were included in the study based on the inclusion and exclusion criteria. The inclusion criteria were; age – 14 – 20 years, only male candidates were considered for the study, players playing basketball regularly from last 1 year at school level. The exclusion criteria were; - presence of pain in any part of upper limb, lower limb, trunk or body which can interfere in training session, - players who had attended any type of proprioceptive training in last one year, - any Cardio-respiratory disorder, audio–visual disorder, any medical condition due to which athlete is on medication during course of the study, any surgical intervention in last 6 months. The subjects were randomly allocated to the two groups, Group A (n=15) and Group B (n=15). The group A underwent the wobble board proprioceptive training program and group B received multi-station proprioceptive training program lasting for four weeks.

Procedure

Testing: Baseline values were measured for the vertical jump height using the Sergeant Jump test *(Shaji and Saluja, 2009)*. In this test, player was asked to stand side on to a wall and reache up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips was marked, this was called as standing reach. The player then stood away from the wall, and jumped vertically as high as possible using both arms and legs to assist in projecting the body

upwards. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height was taken as the score. The best of three attempts were recorded. The readings were taken in centimetres (cms).

Training

Group A:- This training was given for 4 weeks, 3 days/week. The proprioceptive experimental program was conducted with balance board followed by 5 to 10 min warm-up program prior to training which included running, jumping and mild stretching to avoid any injury. The balance board that was used consisted of a wooden disk 16 inches in diameter with a 4-inch half sphere attached to the bottom. The sphere allowed approximately 17° of angulations in all planes. On the wobble board the progressive increase of load was done: according to the protocol enlisted in table 1. In one training unit 4 balance board tasks had been accomplished.

Table 1: conventional training protocol *(McGuine, and Keene, 2006).*

Phase	Surface	Eyes	Exercise
I	**Floor**	**Open**	**Single-leg stance**
Week 1		**Open**	**Single-leg stance while swinging the raised leg**
		Open	**Single-leg squat (30°-45°)**
		Open	**Single-leg stance while performing functional activities (dribbling, catching)**
		Closed	**Single-leg stance**
		Closed	**Single-leg stance while swinging the raised leg**
		Closed	**Single-leg squat (30°-45°)**
II	**Board**	**Open**	**Single-leg stance**
Week 2		**Open**	**Single-leg stance while swinging the raised leg**
		Open	**Single-leg squat (30°-45°)**
		Open	**Double-leg stance while rotating the board**
III	**Board**	**Closed**	**Single-leg stance**
Week 3		**Closed**	**Single-leg stance while swinging the raised leg**
		Closed	**Single-leg squat (30°-45°)**
		Closed	**Double-leg stance while rotating the board**
IV	**Board**	**Closed**	**Single-leg stance while rotating the board**
Week 4		**Open**	**Double-leg stance while performing functional activities (dribbling, catching)**
		Open	**Single-leg stance while performing functional activities (dribbling, catching)**
		Open	**Hopping and Jumping**

Fig. 1: Single limb stance with eyes closed

Fig. 2: Single limb stance on wobble board

Group B:-

This training was given for 4 weeks, 3 days/week. Subjects started each exercise period with a 5- to 10-min warm-up program prior to training which included running, jumping and mild stretching to avoid any injury. The exercise period took 20 min, and single exercises were performed for 45 seconds followed by a 30-seconds break where subjects moved over to the next station. The whole program was performed twice to exercise both feet in the same way. In the first session, the correct posture of the lower leg of the subjects was controlled

(slight external rotation of the foot, slightly flexed knee, and the patella over the metatarsophalangeal joint) during the exercise. The intensity of the 4-wk training period was increased by small modifications for each station every wk. The main goal of this program was to generate a wide variation of different stimuli for strength and coordination.

Stations:

- Exercise mat: - A PVC shrink wrapped with carrying net exercise mat with low thickness was used. The mat of dimensions (H) 0.95cm, (W) 60cm, (L)120cm was used. The exercise program included – double limb stance with eyes closed, single limb stance with open and closed eyes.
- Ankle disk: - An ankle disk that was used consisted of a wooden disk 16 inches in diameter with a 4-inch half sphere attached to the bottom. The sphere allowed approximately 17° of angulation in all planes. The exercise program included – maintain balance on an ankle disk in single-limb and double limb stance.
- Exercise band (Thera-Band ®):- A blue coloured exercise band (Thera-Band ®) was used to maintain balance in single-limb stance with abduction of the contra-lateral leg against resistance of an exercise band.
- Mini trampoline (Cosco®):- A mini trampoline (Cosco®) with 40" diameter made up of heavy gauge steel with spring attached was used. The exercises included - maintainining balance in single-limb stance with eyes open and closed, jumping, hopping.

Uneven walkway (customized):- the uneven walkway was customized with help of tennis balls as a station of multi station training to experience different surfaces in walking.

Fig. 3: Single limb stance on exercise mat with eyes closed

Fig. 4: Jumping on mini trampoline

Statistical Analysis: The mean and standard deviation of all the variables were analysed. Data analysis was done with the help of SPSS for windows version 16.0 in order to verify the investigations of the study. Unpaired t - test was applied to find out whether the improvements in vertical jump height were significant. The significance level set for this study was 95% ($p<0.05$).

Results & Discussion:

The results of the current study depict that multi-station proprioceptive training is more effective in improvement of vertical jump in basketball players. The

improvement in vertical jump was found to be significant at $p<0.01$ level.

Table 1: Comparisons of improvement in vertical jump height of group A and group B at 0th week, 2nd week, 4th week.

Weeks	Vertical jump height of group A	Vertical jump height of group B
0^{th} week	35.07 ± 7.68	40.73 ± 9.99
2^{nd} week	39.67 ± 6.88	48.87 ± 9.88
4^{th} week	46.00 ± 7.96	55.60 ± 9.36

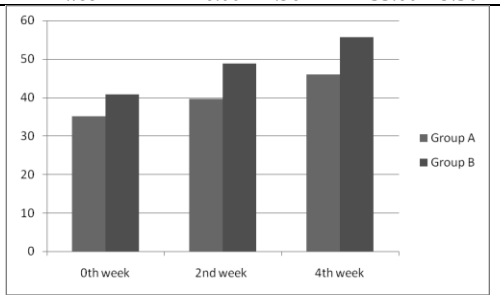

Figure 1: comparisons of improvement in vertical jump height of group A and group B at 0th week, 2nd week, 4th week.

The aim of the study was done to compare the effectiveness of conventional (wobble board) proprioceptive training and multi-station proprioceptive training on the vertical jump performance in basketball players. The results of the conventional proprioceptive training and multi-station proprioceptive training shows 10.93 mean increase in vertical jump in group A and 14.87 mean increase in vertical jump in group B. There was significant improvement in vertical jump height in both groups. Improvement in vertical jump with multi-station proprioceptive training was found to be greater in group B. *Gruber and Golhofer (2004)* had concluded in their study that the possibility of proprioceptive training influence on the neuromuscular system may be due to the initiation of the generated force, i.e. an improvement of explosive strength and neuromuscular activation at the start of a voluntary muscular activity. The improvement of proprioception can have a positive impact on neural activation – excitation of the motor-neural system, especially concerning the stretch-shortening cycle. Previous researches have shown that the proprioceptive training affects the increase in strength of the flexor and extensor muscles of foot *(Trop and Askling, 1988)*. It also affects the increase in the strength of the muscles on the back side of the thigh *(Heitcamp et al, 2001)*. The increase in strength of leg extensor muscles along with the inhibition of stretch reflex can be the reason for the improvement in vertical jumping performance. The proprioceptive training was intended to develop the strength of muscles and the multi-station training would also have helped to increase both the strength and coordination. Studies also suggest that proprioceptive training would help to increase the strength. As the explosive force generation in vertical jumping performance is influenced by the rapid transfer from eccentric to concentric muscle work (stretch-shortening cycle), it is possible that the proprioceptive training may have an effect on the quicker generation of strength as well as on the higher rate and early inclusion of motor units *(Gruber and Golhoffer, 2004)*. *Ya-Wen Liu et al, (2005)* proposed that training on multi-station challenged more muscle and further opined that proprioception is governed by central and peripheral mechanism that come mainly from muscular receptor, but also includes tendinous, articular and cutaneous receptors. The respective roles of these various sources of afferent information have been debated, but it is now

recognized that muscular receptors have the most important part in the elaboration of limb proprioception *(Bouet and Gahery, 2000)*. This role for muscular receptors indicated that modifying the functional state of the muscles could affect the precision of position sense *(Ya-Wen Liu et al, 2005)*.

Eric and Rosenbaum (2001) conducted a study, in which they used multi-station training on 12 different surfaces. They suggested that low frequency exercise is easy to integrate into normal training routines. They found improvement in joint position sense and limited postural sway and a stable base which helped in jumping high. They further concluded that multi-station training reduces reaction time that helps in simultaneous release of force and jump high.

Limitations: While designing the present study it was tried to keep the limitations to the minimum. This study had some of its own limitations which can be summarized as: Only school level basketball players were taken so the result of this study could not be generalized for all population, the study was based on the data collected from males only; for the generalization of the data the study should be conducted on female players, and sample size included for the study was small. Future studies in this area may include a study which can be designed to compare the effect of proprioceptive training on stability trainer and wobble board on other performance variables in basketball players, and can be designed for the 3 – D analysis of balance affecting vertical jump, and study should be designed to analyze the effect of proprioceptive training on postural sway, joint position sense and reaction time.

Conclusions: The results of the current study indicate that Multi-station training showed higher improvements as compared to conventional balance training. Thus, null hypothesis was rejected and experimental hypothesis was accepted.

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Pattern of Neurological Conditions Seen at the Outpatient Paediatric Physiotherapy Unit of a Nigerian Tertiary Hospital: A-five year review

[1]Omole J.O., [2]Olaogun M.O.B., [2]Mbada C.E.

[1]Department of Physiotherapy, Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Osun State. Nigeria. Ile-Ife, email:elidrwiz@yahoo.com

[2]Department of Medical Rehabilitation, Obafemi Awolowo University, Ile-Ife, Osun State. Nigeria.

Abstract

Neurological conditions in children constitute a major source of referral and workload for physiotherapy. This study assessed the pattern of neurological conditions in children seen at the physiotherapy department of a Nigerian tertiary hospital. A five-year retrospective review (January 2008 to December 2012) of children with neurological conditions seen in the Physiotherapy Department of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria was carried out. Data were gleaned on patients' demographic (gender, age and residential address) and clinical (diagnosis and source of referral) variables. A total of 410 paediatric cases were reviewed out of which 294 (71.7%) constituted neurological conditions with a male to female ratio of 1.5:1.0. The mean age of the study's participants was 32.9± 32.5 months. Cerebral Palsy (CP) was the most common neurological condition seen (50.3%) with spastic quadriplegic type as the most common (41.9%). Other types of neurological conditions seen were traumatic sciatic nerve palsy (22.4%), obstetric brachial plexus injury (13.3%), central nervous system infection (7.1%) and facial nerve palsy (1.4%). Physicians' referrals from the paediatric out patient department (27.2%) and children emergency ward (20.7%) followed by self-referral (18%) constituted the most of referrals. 44.2% of the cases were referrals from other satellite towns outside the location of the clinic. In Conclusion Paediatric neurological conditions constitute a huge burden for physiotherapy in Nigeria. CP and traumatic sciatic nerve palsy were the most common neurological conditions. Demographic distribution of neurological conditions seen in this study was similar to findings from previous studies in literature.

Key words: Paediatrics, Physiotherapy, Neurological condition, Workload

Introduction

Neurological disorders in children are common occurrences in clinical practice *(Lagunju and Okafor, 2009)*. These disorders could arise from prenatal, perinatal and postnatal pathological changes or lesions of the peripheral or central nervous system *(Edwards, 2002)*. Genetic factors, chromosomal abnormalities, metabolic disorders and trauma are known to play a significant role with respect to the aetiology of paediatric neurological disorders *(Williams, 2003)*. Specifically, neurological disorders include conditions like cerebral palsy, traumatic nerve palsy, obstetric brachial plexus injury, poliomyelitis, cerebral malaria and head injury *(Adelugba et al, 2011)*. These disorders are usually associated with motor impairments which include low muscle force production, poor motor planning and postural control, irregular muscle tone, limited joint range of motion and poor balance and *coordination (Peters et al, 2008)*. Children with neurological disorders in the developing world are faced with the added burden of poverty, inadequate health facilities, inadequate community services, parental ignorance and illiteracy as well as lack of facilities for rehabilitative care *(Bribeck, 2000)*.

Effective care for children with neurological conditions is often predicated on a multidisciplinary team approach with a cordial understanding between paediatricians and physiotherapists *(Michaud, 2004)*. Physiotherapy over the years has played important roles in the overall management of children with neurological conditions *(Michaud, 2004)*. The physiotherapist intervention for children with neurological conditions is based on training, skill and experience in clinical practice, scientific evidence from research and patients' preference *(Campbell et al, 2006)*. The pattern of neurological conditions seen by physiotherapist may vary from one geographic location to another. The variation in prevalence and pattern of neurological conditions reported in previous studies have been predicated on methodological differences between studies, variation in case definitions and sampling techniques and lack of age adjustment of rates with standard national and international population *(Gourie-Devi et al, 1987; Razdan et al, 1984; Bharucha et al, 1987)*. For example autism, is a common condition among children in the North America *(Baio, 2012; Hirtez et al, 2007)*, while most studies reported attention deficit hyperactivity disorder (ADHD) as the most common behavioural among children in the United Kingdom *(Boston, 2011)*. Available studies from Africa indicate the Cerebral Palsy (CP) is the most prevalent neurological condition among children with varying rates *(Peters et al, 2008; Franks-Briggs and Alikor, 2011; Ogunlesi et al, 2008; Couper, 2002)*. Local and regional studies on the pattern of neurological disorders in children are valuable in understanding trends and characteristic of these conditions and also for preventive health purposes. Studies on pattern of neurological conditions among children attending physiotherapy from rural communities are scant. The objective of this study was to assess the pattern of neurological conditions seen in children attending physiotherapy department in a Nigerian Teaching Hospital.

Materials & Methods:

A five-year retrospective case review (January 2008 to December 2012) of children with neurological conditions was carried out. The setting for the study was the Out-patient Physiotherapy Department of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife, Nigeria. The OAUTHC is strategically located to cater for health needs of people within Osun, Ekiti, and Ondo state, even to some parts of Oyo, Kwara, Edo and Kogi States respectively *(Bello et al, 2004; OAUTHC, 2010)*. Ethical approval for the study was obtained from the Ethics and Research Committee of the OAUTHC. Data were gleaned on patients' demographic (gender, age and residential address) and clinical (diagnosis and source of referrer) variables. Data was analyzed using descriptive statistics of frequency and percentages on SPSS version 17.0.

Results

A total of 410 paediatric cases were reviewed out of which 294 (71.7%) constituted neurological conditions. The mean age of the children was 32.9± 32.5 months with a male to female ratio 1.5:1.0. The highest number of cases recorded was in 2012.

Table 1: Socio-demographic and Clinical Characteristics of the Children with Neurological Conditions Seen at the Physiotherapy Department (N=294)

Variable	Frequency	Percentage %
Age at first contact		
0-12 Months	127	43.2
≤ 5 years	122	41.5
≤ 10 years	28	9.5
≤ 13 years	17	5.8
Gender		
Male	176	59.9
Female	118	40.1
Patients' Residential Location		
Within town	214	72.8
Outside town	80	27.2
Neurological Condition		
a. Cerebral Palsy	148	50.3
b. Traumatic sciatic nerve injury	66	22.4
c. Obstetric brachial plexus injury	39	13.3
d. Central nervous system infection	21	7.1
e. Head injury	4	1.4
f. Facial nerve palsy	4	1.4
g. Down's syndrome	4	1.4
h. Radial nerve palsy	3	1
i. Spinal bifida	2	0.7
j. Paralysis of Unspecified diagnosis	2	0.7
k. Paralysis due to cancer	1	0.3

Table 1 shows the ages of children at first contact, gender distribution, domicile of patients and the various types of neurological conditions seen. The age group of 0-12 months constituted the age bracket with the highest proportion of neurological disorders (43.2%) while children who were 11 years and above accounted for 5.8% of the study population. In Table 2 the highest rates of referrals were from the Paediatric Out-Patient Department (27.2%) and Children Emergency Ward (20.7%) respectively. Self referral constituted 18% of the referrals. 55.8% of the referees were resident with the clinic location town.

Table 2: Pattern of Referral of Paediatric Neurological Conditions seen at Physiotherapy Clinic

Variable	Frequency	Percentage %
Source of referral		
Physician	241	82
Physiotherapists and Self	53	18
Place of referral		
Children Emergecy Ward	61	20.7
UCHC, Eleyele	17	5.8
Children Outpatient Department	80	27.2
Neurosurgery Clinic	6	2
Orthopaedic Clinc	28	9.5
Neonatal Clinc	3	1
Paediatric Neurology Clinic	14	4.8
Hospital Ward	26	8.8
Others	53	18
Outside the Hospital	5	1.7

PT's: Physiotherapists, UCHC: Urban comprehensive health centre, CEW: Children Emergency Ward, COPD: Children Outpatient Department
PNC: Paediatric Neurology Clinic

Cerebral palsy constituted the most common neurological conditions (50.3%) in the study. Specifically, spastic quadriplegic type was the most common type of CP. Birth asphyxia (40.5%) was the major aetiology for CP. Table 3 shows frequency distribution of the types of cerebral palsies seen. Traumatic Sciatic Nerve Palsy accounted for 22.4% of neurological conditions. Injection neuritis (92.4%) was the main cause of TSNP. Obstetric Brachial Plexus Injury accounted for 13.3% of neurological conditions and increase in birth weights greater than or equal to 3.9Kg was the leading aetiology (43.6%). Cerebrospinal meningitis accounted 42.9% of neurological conditions caused by central nervous system infection.

Neurological Cnditions	Frequency	Percentage
1. Type		
a. Cerebral Palsy		
Spastic Quadriplegia	**62**	**41.9**
Spastic Diplegia	**26**	**17.6**
Spastic Hemiplegia	**22**	**14.9**
Spastic Monoplegia	**4**	**2.7**
Hypotonic	**6**	**4**
Ataxia	**5**	**3.4**
Mixed	**6**	**4**
Normal	**13**	**8.8**
Unknown	**4**	**2.7**
b. Central Nervous System Infections		
Cerebrospinal meningitis	**9**	**42.9**
Poliomyelitis	**4**	**19**
Tetanus	**3**	**14.3**
Encephalitis	**3**	**14.3**
Measles	**2**	**9.5**
2. Causes		
A. Cerebral Palsy		
Birth Asphyxia	**48**	**32.4**
Kernicterus	**26**	**17.6**
Febrile Seizures	**20**	**13.5**
Prematurity	**10**	**6.8**
Neonatal Seizures	**3**	**2**
Head Injury	**8**	**5.4**
Unknown	**14**	**9.5**
Multiple (Combination of several causes)	**19**	**12.8**
B. Traumatic sciatic nerve palsy		
Injection neuritis (Dorsogluteal Trama)	**61**	**92.4**
Trauma	**2**	**3**
Breech Presentation	**1**	**1.5**
Unknown	**2**	**3**
C. Obstetric brachial plexus injury		
Birth weights (≥ 3.9kg)	**17**	**43.6**
Shoulder dystocia	**10**	**25.6**
Immunisation	**1**	**2.6**
Breech Delivery	**3**	**7.7**
Trauma (Fall)	**2**	**5.1**
Umblilical Cord Compression	**1**	**2.6**
Unknown	**5**	**12.8**

Discussion

This study assessed the pattern of neurological conditions in children seen at the physiotherapy department of a Nigerian tertiary hospital. The result of the study showed that neurological conditions (71.7%) were the most prevalent paediatric conditions referred for physiotherapy within the study period. This result is comparable with the findings of *Adelugba et al (2011)* which showed that paediatric neurological conditions accounted for 72.9% of the total number of paediatric cases for physiotherapy at a federal hospital in a rural community in Nigeria. In concert, some previous studies have shown high rates of neurological disorders among children with consequent co-morbidity and disability *(Hamzat and Omotade, 2006; Adelugba et al, 2011; Frank-Briggis and Alikor, 2011; Onwuekwe and Ezeala-Adikaibe, 2011).*

Cerebral palsy accounted for the highest rate (50.3%) of referral for physiotherapy among children in this study. This finding is consistent with other studies from Nigeria that have reported that CP was the most prevalent paediatric neurological condition seen by physiotherapists *(Adelugba et al, 2011; Peters et al, 2008).* Furthermore, spastic quadriplegia was found to be the most common type of cerebral palsy. This finding is also consistent with the submission of *Peters et al (2008)* that spastic quadriplegia is the most predominant type of CP managed at the physiotherapy department of a Nigerian Teaching Hospital. Cerebral palsy is a common neurological disorder of childhood with significant neurological complications and associated comorbidities *(Franks-Briggs and Alikor, 2011).* In Nigeria, birth asphyxia, severe neonatal jaundice and prematurity appears to be the most important factors associated with cerebral palsy *(Azubuike and Nkanginieme, 2007).* It is alluded that the high rate of CP observed in this study is possibly as a result of high rates of

unsupervised deliveries *(Mcgil-Ugwu et al, 2012)* and mother's poor knowledge about risk factors and consequence of birth asphyxia as opined by other studies *(Ogunlesi et al, 2013)*. According to World Health Organisation, an estimated one million children who survive birth asphyxia live with chronic neurodevelopmental morbidities including cerebral palsy, mental retardation, seizure disorders and learning disabilities *(WHO, 2005)*. But *Nelson, (2008)* concluded that even though the aetiology of cerebral palsy is impressive in its preservative preoccupation with birth asphyxia, this only marks a minor part of the entire causes. In addition, *Hare et al (1998)* noted that infantile cerebral paralysis was caused by prenatal abnormalities, birth asphyxia being a marker for, rather than a cause of brain dysfunction.

The second most common reason for patient's referral for physiotherapy intervention in this study was traumatic sciatic nerve palsy with injection neuritis as the major cause. This result corresponds with the findings of Hamzat and *Omotade (2006)*. Sciatic nerve injury most commonly occurs as a result of a misplaced injection in the buttocks in early childhood *(Howlett, 2012)*. All the cases observed in this study resulted after administration of gluteal intramuscular injection despite the world's Health Organisation recommendation against the use of dorsogluteal as injection sites but support either the use of ventrogluteal or anteriolateral thigh as injection sites for vaccination *(WHO, 2004)*. *Plotkin et al, (2008)* advocated the use of ventrogluteal site for all ages as a safer way of administering intramuscular injections. Also *Malkin (2008)* concluded that dorsogluteal site should be removed from the injection practice as an unnecessary and unacceptable risk for patients including children. The recovery rate of children with traumatic sciatic nerve palsy is inadequate *(Bagis et al, 2012)* and this is because the sacral plexopathies reinnervate so poorly: the excessive regeneration distance prevents effective proximodistal regeneration *(Wilbourn, 2006; Wilbourn, 2005)*.

From this study, obstetric Brachial Plexus Injury was found to be a common paediatric neurological condition with greater birth weights of 3.8kg as the major cause. This finding is in agreement with *Pondaag et al, (2011)* but other studies implicate birth trauma at delivery as the major cause *(Evans-Jones et al, 2003)*. Brachial plexus injuries are almost always recognized in the labour suite *(Piatt, 2004; Royal, 2013)* and is a complication of childbirth *(Bialocerkowski and Galea, 2006; Wilbourn, 2005)*. Brachial plexus is often damaged when it is under tension *(Royal, 2013)*. *Ugboma et al, (2010)* stated that erb's palsy is on the rise and recommended measures to control excessive weight gain in pregnancy and prevent overweight. This is in contrast to a study done by *Chauhan et al, (2005)* which stated that the rate of macrosomia seen in erb's palsy is on the decline. Cerebrospinal meningitis still remains the most common form of central nervous system infection (42.9%). This result is also consistent with the findings of *Frank-Briggs and Alikor, (2011)* that central nervous system infection was mostly due to bacterial meningitis.

Conclusion:

Paediatric neurological conditions constitute a huge burden for physiotherapy in Nigeria. CP and traumatic sciatic nerve palsy were the most common neurological conditions. Demographic distribution of neurological conditions seen in this study was similar to findings from previous studies in literature.

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Effect of Back Extension Exercise on Quality of Life & Back Extensor Strength of Women with Osteoporosis

Goyal[1], M., Kumar[2], Ashok, Moitra[3], M. & Pathania[4], A.

[1]Ass. Professor & Head, MM Institute of Physiotherapy & Rehabilitation, MM University, Mullana, Haryana, India. E-mail: manu_goyal1902@yahoo.co.in

[2]Assistant Professor, Department of Sports Science, Punjabi University Patiala

[3]Ass. Professor & Head, MM Institute of Physiotherapy & Rehabilitation, MM University, Mullana, Haryana, India

[4]MPT Student, MM Institute of Physiotherapy & Rehabilitation, MM University, Mullana, Haryana, India

Abstract

The purpose of the study was to observe the effect of back extension exercise on quality of life and back extensor strength of women with osteoporosis. A sample of 30 subjects in the age group of 45 to 60 years were assessed and selected on the basis of inclusion and exclusion criteria. After obtaining their consents, the subjects were randomly allocated in the Experimental Group-A and the Control Group-B. Group A was given moist heat pack and back strengthening exercise and Group B was given hot pack and isometric exercise 1 set (10 repetitions) a day, 5 days a week for 4 weeks. The independent variables were back extension exercise and isometric exercise. The dependent variables were quality of life and back extensor strength. It is concluded that both the back extension exercise and back isometric exercise are effective in increasing back extensor strength and improving quality of life; however results suggest that back extension exercise is more effective than back isometric exercise in increasing back extensor strength and improving quality of life in post menopausal osteoporotic female patients.

Key words: Osteoporosis, Strength, Oswestry Disability Index.

Introduction

Osteoporosis is a disorder generally affecting the biomechanical competence of bone leading to an increased risk of fractures. It is a skeletal disorder characterised by a reduction in bone mass with accompanying micro architectural damage that increases bone fragility and risk of fracture *(Bijvojet et al., 1989)*. The primary osteoporosis refers to the condition when it occurs in the aging population when a secondary predisposing condition cannot be found. Thus, the primary condition includes both postmenopausal osteoporosis and osteoporosis of aging. The clinical hallmark of the disease is fracture, which most characteristically occurs in the spine, femoral neck, or distal radius, although it may occur in the pelvis, humerus, or any other bone and is associated with minimal trauma. As bone mass declines with menopause and age, fracture frequency also increases with age *(Hui et al., 1988; Riggs & Melton 1986)*. Osteoporotic fractures are most common in postmenopausal women and in elderly persons of both sexes and typically occur with moderate trauma. Bone mass is the major determinant of fracture risk with bone strength being 80-90% dependent on bone mass. Several studies in young adults show a correlation between bone mineral density and physical activity level, suggesting that exercise might increase

peak bone mass *(Aloia et al., 1988; Kanders et al., 1988)*. Along the same lines, immobilization or reduction in weight-bearing physical activity is well known to reduce bone mass, as demonstrated in paraplegia, poliomyelitis, space flight and bed rest for unrelated conditions *(Steinberg 1980)*. In women, the rate of bone loss accelerates for several years before actual menopuause (during partial ovarian failure), and for as long as 10 years after complete cessation of ovarian function *(Mazees, 1982; Riggs et al., 1981)*. The majority of evidence supports the importance of estrogen deficiency at menopause as the major factor in rapid bone loss and subsequent osteoporotic fractures *(Lindsay, 1988; Nilas & Christiansen, 1987)*. Its pathophysiological basis includes a genetic predisposition to low peak bone mass and subtle alterations in bone remodelling due to changes in systemic and local hormones, coupled with environmental influences. The loss of estrogen at menopause increases the activation rate of more bone remodelling sites. Because resorption slightly exceeds formation in remodelling units, this elevated activation rate causes a net increase in skeletal resorption and hence bones loss, particularly on the endosteal surface of cortical bone and in cancellous bone. In addition, estrogen withdrawal may result in actual eradication of some trabecular units, this being caused by increased size or depth of resorption cavities *(Parlitt, 1987)*. The pathogenesis of osteoporosis reflects the complex interplay among genetic, metabolic, and environmental factors that determine bone growth, peak bone mass, calcium homeostasis and bone loss. These factors are influenced by aging, physical inactivity, sex hormone deficiency, nutritional status. From the fourth decade onward, there is a remodelling imbalance at individual foci such that less bone is formed than is resorbed in most modelling units. This may be caused by impaired regulation of the osteoblast population rather than by intrinsic cellular osteoblast dysfunction. Back extensor strength has been of considerable importance in patients with osteoporosis. Osteoporotic women had significantly lower back extensor strength than healthy women. Back extensor strength was the most significant contributor to the spinal mobility, which had a strong effect on quality of life on patients with osteoporosis. Therefore, strengthening exercises for back extensors are recommended in management of patients with osteoporosis. While the cause of low back pain is multifactorial, many authors have suggested that osteoporosis can result in back pain in post menopausal women. Studies have been conducted to see correlation between muscle strength and bone mineral density of vertebral bodies. These studies demonstrate a positive correlation of the bone density and strength of back extensors. In 1982, it was reported that the combination of a few exercises with avoidance of flexion can safely and effectively strengthen the fragile osteoporotic spine. Chow's group randomized post-menopausal women to participate in aerobic, aerobic plus strengthening, or no exercise three times per week for 1 year and found significantly increased bone mass in the exercising groups, as compared with those who did not exercise *(Chow et al., 1987)*. Bone mineral density of lumbar vertebrae was found to correlate significantly with the

strength of back extensor muscles *(Sinaki et al., 1986)*. Back extensor strength is the most significant contributor to the spinal mobility, which has a strong effect on quality of life in patients with osteoporosis.

Materials & Methods

A sample of 30 subjects in the age group of 45 to 60 years were assessed and selected on the basis of inclusion and exclusion criteria i.e. osteoporotic females diagnosed by physician as per diagnostic criteria, chronic back pain and their back strength with baseline measurement of 30 kg. After obtaining their consents, the subjects were randomly allocated in the Experimental Group-A and the Control Group-B. Group A was given moist heat pack and back strengthening exercise (Back extension exercise in a prone position with a pillow under the abdomen) 1 set (10 repetitions) a day, 5 days a week for 4 weeks. Group B was given hot pack and isometric exercise 1 set (10 repetitions) a day, 5 days a week for 4 weeks. The independent variables were back extension exercise and isometric exercise. The dependent variables were quality of life and back extensor strength. The outcomes were measured with back strength dynamometer for measuring back extensor strength and Oswestry Disability Index Questionnaire gives a percentage score that indicates each patient's level of functional disability.

The data was analysed using SPSS 17 software package. Statistical analysis for the two groups was performed to find out the mean, standard deviation and the statistical significance between ODI and dynamometer in both the groups. A paired t- test was used to compare the within groups values of ODI and dynamometer and unpaired t - test was used for between group comparison of ODI and dynamometer. The results were rated to be significant at $p < 0.05$.

Results & Discussion

The mean age of Group-A was 51.53 years with standard deviation of 3.543 and that of Group-B was 52.00 years with standard deviation of 3.485. The difference in the mean age of two groups was not statistically significant (t=2.05, p=0.178) (Table 1).

Table 1: Comparison of age between Group A & Group B

GROUP	MEAN± SD	T - VALUE	P - VALUE P<0.05	RESULT
A	51.53 ± 3.54	2.05	0.718	Non-significant
B	52.00 ± 3.48			

Table 2 shows the baseline comparison of Mean±SD scores of ODI and back strength between group-A and group-B. It was found that there was not statistical significant difference in pre-treatment scores of ODI and Back strength between different groups (Table 2).

Table 2: Baseline comparison of Mean± SD scores for ODI and Back strength between Group-A & Group-B

Group	A	B
ODI	34.27± 4.65	31.25± 4.10
Back Strength	32.67± 3.71	34.0± 4.70

ODI – Oswestry Disability Index

Within Group Comparison- the mean range of Oswestry Disability Index questionnaire (ODI) and Back strength scores of Group-A and B were taken at day 0 (before treatment) and after 4 - weeks of intervention. Paired t- test was used to compare the data within the group.

Table 3: Comparison of Mean ± S.D of ODI and Back strength within Group -A

Variable	Pre-treatment	Post-treatment	t-value	p- value (< 0.05)
ODI	34.27± 4.65	32.27± 7.04	2.14	significant
Back strength	32.67± 3.71	34.00± 3.38	2.14	significant

Table 3 shows that there was no significant difference in the pre treatment scores of ODI and Back strength in Group-A. But a paired-t test analysis revealed that there was statistically significant improvement in post-treatment scores of ODI ($t=2.14$, $p<0.05$) and Back strength ($t=2.14$, $p<0.05$) (Table 3).

Table 4 shows that there was no significant difference in the pre treatment scores of ODI and Back strength in Group-B. But a paired-t test analysis revealed that that there was statistically significant improvement in post treatment scores of ODI ($t=2.14$, $p<0.05$) and Back strength ($t=2.14$, $p<0.05$).

Table 4: Comparison of Mean ± S.D of ODI and Back strength within Group-B

Variable	Pre-treatment	Post-treatment	t - value	p- value (< 0.05)
ODI	31.25± 4.10	24.80± 8.40	2.14	significant
Back strength	34.00± 4.70	38.33± 5.20	2.14	significant

The difference in the mean values of scores of ODI and back strength between group-A and group-B was calculated by using unpaired t-test. Results of inferential statistical analysis revealed that there was statistically significant difference between post scores of QOL and Back strength in both groups. Further, it was found that group-B was showing more improvement in the mean scores of ODI ($t=2.05$, $p<0.05$) and back strength ($t=2.05$, $p<0.05$) than group-A at p-value < 0.05. Thus, the result of this study shows that there was an increase in back strength scores in both groups but the back extensor exercise group (Group-B) showed a statistical significant difference in outcome measures as compared to isometric exercise program (Group-A) (Table 5).

Table 5: Comparison of Mean± SD of ODI and Back strength between Group-A & Group-B

Variables	Group A	Group B	t-value	p- value (< 0.05)
ODI	2.00± 2.619	7.07 ± 7.005	2.05	significant
Back strength	1.33± 2.289	4.33± 4.952	2.05	significant

Discussion

The main objective of the present study was to see the effects of back extension exercise. The results of the present study showed that there was significant improvement in pre-test scores of quality of life and back extensor strength in back extension exercise group than isometric exercise group respectively. Some exercise programmes often called back extension exercises are designed to enhance trunk performance through the training of long trunk muscles (erector spinae and rectus abdominis), whose primary function is to generate movement. In chronic low back postmenopausal osteoporotic patients the effect of extension exercises show increase in strength of erector muscles of spine. However for postmenopausal osteoporotic patients it is difficult to perform many exercises. The mechanism, how back extension exercise training affects back pain and disability has been gained from another randomised clinical trial which examined the effect of backward bending of lumbar spine on intervertebral disc. The subjects were given moderate lumbar flexion and four degrees of lumbar extension exercise and found that posterior annulus can be stress shielded by the neural arch in extended postures and this

may explain why extension exercise decrease back pain in some patients. However, a study done by *Dettori et al (1995)* investigated the effects of spinal flexion and extension exercises and their associated postures in patients with acute low back pain. The results concluded that flexion and extension exercises groups did not differ in any outcome over 8-weeks. Another study on relative effectiveness of an extension programme and a combined programme of manipulation and flexion and extension exercises in patients with acute low back syndrome and concluded that extension/mobilization followed by both flexion and extension results in more rapid resolution of symptoms and improvement in functional limitations than an established extension programme alone. The present study is support the findings of *David et al (2007)* reported the effectiveness of an extension oriented treatment approach in a subgroup of subjects with low back pain and the results concluded that subjects who received an extension oriented treatment experienced significantly greater improvements in disability than subjects who received an alternative trunk strengthening that both spinal flexion and extension exercises provided significant reduction programme at one week. In the present study back extension exercise was effective in improving back extensor strength and quality of life in post menopausal osteoporotic females; however back isometric exercise group also showed improvement in back extensor strength and quality of life in post menopausal osteoporotic females but not as significant as back extension exercise group.

Conclusion: It is concluded that both the back extension exercise and back isometric exercise are effective in increasing back extensor strength and improving quality of life; however results suggest that back extension exercise is more effective than back isometric exercise in increasing back extensor strength and improving quality of life in post menopausal osteoporotic female patients.

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Relationship between Blood Lactate, Load and Load Volume in Weight Lifters

Kumar[1], Ashok & Reena[2]

[1]Assistant Professor, Department of Sports Science, Punjabi University Patiala (Punjab) India, Email: akashokin@gmail.com.

[2]M.Sc. Sports Science Student, Department of Sports Science, Punjabi University Patiala (Punjab) India

Abstract

The purpose of this study was to observe the relationship between effects of different workload and load volume (i.e. 3 RM, 6 RM, 9 RM) of power clean on blood lactate production in female weight lifters. A total of six weight lifters with mean age, height and weight of 20.5 ±2.8 years, 161± 6.5cm and 70±7.4Kg respectively volunteered to participate in this study. Each subject's blood lactate was measured at rest and after 3RM, 6RM & 9RM with the help of a digital portable lactate analyzer (Lactate Scout) and the data were analyzed using Mean ±SD, T-test and correlation (Pearson).The maximum mean of relative absolute and %percent increase of blood lactate was 8.7±2.3mmol and 370.0±109.3% (3RM) followed by 7.4±2.0mmol & 349.8±112.0% (6RM) and 5.33±1.96mmol &33.3±81.3% (9RM).The difference in blood lactate at rest and after the execution of different work load volume was statistical significantly ($p < .05$). Insignificant correlation was found between the load lifted, load volume and posttest blood lactate in 3 RM, 6 RM and 9 RM. But when the data of different work load volume pattern was pooled together, there was a statistical significant negative correlation between load volume, posttest blood lactate ($r = -0.63$, $p<.01$), relative absolute ($r = -0.61$ $p<.01$) and percent increase in blood lactate ($r = -0.57$, $p<.05$). It was concluded that the blood lactate response depends upon the maximum absolute load lifted by the weight lifters as compared to the volume of load lifted. In other words, we can say that blood lactate production was largely dependent on the percentage of 1RM lifted.

Key words: Lactate, 1RM, Power clean

Introduction

Glycolysis is the conversion of glucose to pyruvate in order to generate ATP. The process primarily occurs in the cytosol, where glycolytic enzymes are in abundance. Sixteen steps of this process have been identified and the primary enzymes involved in this process are phosphofrucktokinase (PFK), phosphate dehydrogenase, and lactate dehydrogenase (LDH) *(Brooks et al., 2005).* One fate of pyruvate is oxidation that can yield additional ATP. This process also takes place in the mitochondria, where pyruvate is converted to acetyl CoA. Acetyl CoA enters Kreb's cycle to be oxidized to carbon dioxide. Eventually, ATP is formed as electrons are transferred to oxygen. This process is known as aerobic respiration *(Bergeron, 1991).* Under very high energy demands, the NADH and H^+ must be converted to NAD^+ to allow glycolysis to continue. In this situation the available pyruvate is reduced to lactate to facilitate the rapid regeneration of NAD^+ and the continued rapid production of ATP via glycolysis. This process facilitates continuous glycolysis but results in less ATP generation and increased lactate production *(Wassermann et al., 1986).* The interaction between fast and slow glycolysis is a major determinant of human

performance during prolonged and/or strenuous activities. Metabolic reactions required to provide energy during such activities create acidic conditions due to the production of lactic acid and associated increase in H^+ *(Gollnick et al., 1986; Brooks 1986)*. It is necessary to list that, lactate production is higher in type II muscle fibers and during the recruitment of large to intermediate motor units *(Jones & Ehrsam, 1982)* as can occur in the Olympic style weight lifting techniques such as the clean and jerk, power cleans and the snatch. Working at the intensity which facilitates significant lactate is important to improve lactate tolerance. Little is done to evaluate the relationship between the effects of load, load volume of Olympic style lifts and lactate production in female weightlifters. Hence, due to the lack of referring literature, this study utilized only female weightlifters as participants.

Materials & Methods

The design of this study required participants to perform different work load volume of power clean (3 RM, 6 RM, 9 RM) in Olympic style. Six trained female weight lifters (N=6) between the ages of 17 and 25 years volunteered for this study. Olympic style lifts training session and subsequent blood lactate analysis were conducted at the Gymnasium Hall, Department of Sports, Punjabi University Patiala Campus. Participants performed one volume pattern on each day. Three total days were required for each participant to complete the study. A rest period of 48 hours was observed between the training days. Participants refrained from taking curd/lassi or whey/fermented milk in the last 2-3 hours and participating in any heavy physical activity (except activity of daily living) within 24 hours of the testing day. Blood lactate was analyzed at the beginning and at the end of every session using a digital portable lactate analyzer (Lactate Scout). The device required only 0.5 microliters (µl) whole blood. The blood was drawn from the tip of the index finger.

Statistical Analysis: Data was analyzed using Mean ±SD, T-test and Correlation (Pearson) with the help of statistical software SPSS version 16.0 (free trial, SPSS Inc, Chicago). The alpha level of significance for the data analysis was $p<0.05$.

Results

The mean age, height and weight of the female weightlifters was 20.5±2.8 years, 161±6.5cm and 70.0±7.4kg respectively. The mean load lifted for three repetitions (3RM), six repetitions (6RM) and nine repetitions (9RM) was 53.3 Kg ±12.1 Kg, 30.0Kg±7.7Kg and 32.5 Kg±5.2 Kg respectively. Thus, the maximum load lifted was during 3RM followed 9 RM and 6RM. In addition, the total load volume of each volume pattern was calculated (Volume =Set*load*repetitions). The mean load volume for volume pattern-3RM, 6RM and 9RM was 155.0 Kg ± 37.5Kg, 180.0Kg ± 46.4Kg and 292.5 Kg ± 47.1 Kg. Thus, the maximum volume of load was during 9RM followed by 6RM and 3RM (Table1). According to the literature, 3RM for the resistance training exercises is estimated to be 93% of 1RM while 6RM and 9RM are at 85% and 77% respectively *(Baechle & Earle 2008)*. The mean blood lactate levels for volume pattern-3RM was 2.3±0.2mmol/l prior to exercise and 11.1± 2.3 mmol/l after the completion of one set of three repetitions.

The mean blood lactate level for volume pattern-6RM was 2.2±0.3 mmol/l prior to exercise and 9.5±1.7mmol/l after the completion of one set of six repetitions. The mean blood lactate levels for volume pattern-9RM was 2.28± 0.2 mmol/l prior to the exercise and 7.6 ±2.0 mmol/l after the completion one set of nine repetitions (Table1).

Table 1.Descriptive Statistics of Female Weight Lifters

Age years	Height cm	Weight kg	Load Pattern	Load kg	Load Volume kg	Blood Lactate PreTest, mmol	Blood Lactate PostTest, mmol	Relative Absolute Increase mmol	Relative %Percent Increase
			3RM	53.3±12.1	155.0±37.5	2.3±0.2	11.1±2.3	8.7±2.3**	370.0±109.3**
20.5±2.8	161±6.5	70.0±7.4	6RM	30.0±7.7	180.0±46.4	2.2±0.3	9.5±1.7	7.4±2.0**	349.8±112.0**
			9RM	32.5±5.2	292.5±47.1	2.2±0.2	7.6±2.0	5.3±1.9**	233.3±81.3**

**** Significant at p<0.01, *significant at p<0.05**

It was found that before the start of execution of different work load pattern, the mean blood lactate of female weight lifters were in a normal range that is 2.38±0.21mmol (3RM), 2.21±0.36 mmol (6RM), and 2.28±0.27 mmol (9RM). Further, It was found that the maximum mean of relative absolute and percent increase value of blood lactate was 8.71±2.38 mmol and 370.06±109.38 % (3RM) followed by 7.45±2.02 mmol & 349.81±112.09 % (6RM) and 5.33±1.96 mmol & 33.31±81.32% (9RM) (Table1). Table 2 shows the relationship among the load, load volume, blood lactate posttest, relative absolute and percentage increase of blood lactate. Non-significant correlation was found between the load lifted and blood lactate posttest (r=-0.35), relative absolute (r =-0.34) and percent (r =-0.23) increase in blood lactate for 3RM. Similarly non-significant relationship was found between load volume and blood lactate posttest (r=-0.35), relative absolute (r=-0.36) and percent (r=-0.29) increase in blood lactate for 3RM. However, there was a significant positive correlation between blood lactate posttest and subsequent relative absolute (r=0.99, p<.01) and percent increase in blood lactate (r= 0.92, p<.05).

Table 2.Correlation among load, load volume & blood lactate response of 3RM

	Blood Lactate PostTest	Relative Absolute Increase in Blood Lactate	Relative % Increase in Blood Lactate
Load,kg	-0.35	-0.34	-0.23
Load Volume,Kg	-0.35	-0.36	-0.29
Blood Lactate PostTest, mol	-	0.99**	0.92**
Relative Absolute Increase in Blood Lactate, mol		-	0.95**

**** significant at p<0.01, * significant at p<0.05**

Table 3 shows the non-significant correlation between the load lifted and blood lactate posttest (r=-0.18), relative absolute(r=--0.01) and percent (r=-0.03) increase in blood lactate for 6RM. Similarly, non-significant relationship was found between load volume and blood lactate posttest (r=-0.18), relative absolute(r=-0.01) and percent(r=-0.03) increase in blood lactate for 6RM.However, there was a significant positive correlation between blood lactate posttest and subsequent relative absolute

(r=0.98, p<.01) and percent increase in blood lactate (r = 0.89, p<.05).

Table 3.Correlation among load, load volume & blood lactate response of 6RM

	Blood Lactate PostTest	Relative Absolute Increase in Blood Lactate	Relative % Increase in Blood Lactate
Load, kg	**-.18**	**-.01**	**-.03**
Load Volume, Kg	**-.18**	**-.01**	**-.03**
Blood Lactate PostTest, mol	**-**	**.98****	**.89***
Relative Absolute Increase in Blood Lactate, mol		**-**	**.90***

**** significant at p<0.01, * significant at p<0.05**

Table 4 shows the non-significant correlation between the load lifted and blood lactate posttest (r=-0.51), relative absolute (r=-0.55) and percent (r=-0.60) increase in blood lactate for 9RM. Similarly non-significant relationship was found between load volume and blood lactate posttest (r=-0.51), relative absolute(r=-0.55) and percent (r=-0.60) increase in blood lactate for 9RM. However, there was a significant positive correlation between blood lactate posttest and subsequent relative absolute (r =0.99, p<.01) and percent increase in blood lactate (r = 0.91, p<.05).

Table 4.Correlation among load, load volume & blood lactate response of 9RM

	Blood Lactate PostTest	Relative Absolute Increase in Blood Lactate	Relative % Increase in Blood Lactate
Load, kg	**-.51**	**-.55**	**-.60**
Load Volume, Kg	**-.51**	**-.55**	**-.60**
Blood Lactate PostTest, mol	**-**	**.99****	**.91***
Relative Absolute Increase in Blood Lactate, mol		**-**	**.95****

**** Significant at p<0.01, *significant at p<0.05**

Table 5 shows the relationship among the load, load volume, blood lactate posttest, relative absolute and percentage increase of blood lactate of pooled data. Non-significant correlation was found between the load lifted and blood lactate posttest (r=0.20), relative absolute(r=0.19) and percent (r=0.12) increase in blood lactate. However there was a significant negative relationship between load volume and blood lactate posttest (r=-0.63, p<.01), relative absolute(r= -0.61, p<.01) and percent (r= -0.57, p<.05) increase in blood lactate. A significant positive correlation was also found between blood lactate posttest and subsequent relative absolute (r=0.99, p<.01) and percent increase in blood lactate (r=0.91, p<.05).

Table 5.Correlation among load, load volume & blood lactate response of pooled data

	Blood Lactate PostTest	Relative Absolute Increase in Blood Lactate	Relative % Increase in Blood Lactate
Load,kg	**.20**	**.19**	**.12**
Load Volume,Kg	**-.63****	**-.61****	**-.57***
Blood Lactate PostTest, mol	**-**	**.99****	**.91****
Relative Absolute Increase in Blood Lactate, mol		**-**	**.94****

**** Significant at p<0.01, *significant at p<0.05**

Thus, results of this study suggests that further research work should be taken with volume pattern consist of three sets with three repetitions, the results such study may more deeply and widely interpret the production of blood lactate in response to different work load volume pattern. In addition, when the relative increase in blood lactate was analyzed, it was observed that higher load is associated with higher lactate response as 3RM showed mean relative increase of

370.06±109.38% as opposed to mean relative increase of 349.81±112.09 % and 233.31±81.32 in work load volume pattern 6RM and 9RM respectively (Table 1).

Discussion

In the present study, it was observed that lactate response is largely dependent on the percentage of 1RM lifted. This is in line with propositions put forward by *Reynolds et al, (1997)* who analyzed long term effects of resistance training on lactate response and proposed that blood lactate response is largely dependent on percentage of 1RM lifted. To corroborate the association between higher lactate response and load; *Robergs et al, (1991)* concluded that the rate of glycogenolysis was twofold greater during leg extension at 70% of 1RM than 50% of 1RM, possibly due to the greater involvement of Type II muscle fibers. While findings of these studies give clear indications that lactate response in resistance exercise is largely dependent on load. *Rozenek et al, (1993)* observed that, in bench press exercise when numbers of repetitions are constant; there is an association between elevated blood lactate response and higher volume. This study analyzed the volume of bench press exercise performed for 10 repetitions at 50% and 70% of 1RM. Mean 1RM for this study was at 87.4 kg. Therefore, 10 repetitions performed at 70% of 1RM measured the volume of 611.8 kg. Mean blood lactate response generated at this volume was 9.5mmol/l which is higher than mean lactate response generated at 50% of 1RM (2.5mmol/l). These observations are similar to the present study in which 3RM work load volume pattern with smallest number of repetitions (i.e. three) but highest amount of load percentage has yielded greatest lactate response. The literature indicates that lactate production occurs more in Type II muscle fibers and in larger muscle groups *(Robergs et al, 1991; Jones & Ehrsam, 1982)*. In regards to the aforementioned findings, it is important to revisit the process of energy production through glycolysis. *Bergeron (1991)* reported that glycolysis results in the formation of pyruvate, $NADH^+$, H^+ and ATP. While ATP is used for energy production; pyruvate, $NADH^+$ and H^+ is further processed through aerobic respiration and electron transfer chain, respectively. When the rate of energy requirement exceeds electron diffusion, pyruvate is converted to lactate. However, in intense exercise and continued energy demand, the rate of lactate production exceeds oxidation and lactate accumulates. Thus, this study confirms that lactate accumulation is closely associated with increased energy demand. It is possible that the 3RM work load volume patterns in this study overwhelmed the aerobic capacity, which may have resulted in exceedingly higher blood lactate response. Less time spent while performing higher percentage of 1RM work load (3RM) may be another determinant contributing to the elevated lactate response in volume patterns performing greater repetitions. This indicates that resistance training with enhanced lactate production coupled with an aerobic activity to increase lactate clearance may work to enhance lactate tolerance. However, further research is required to determine the efficacy of resistance-only training to improve lactate tolerance. This finding can be important in athletic settings as most field sports such

as football, hockey and tennis feature continuous, intense activity which can elicit greater lactate response.The results of this study indicate that Olympic style weight lifting can stimulate sufficient lactate production in order to overload the lactate clearance mechanism. However, the limited numbers of participants in this study limit the validity of the results. Moreover, the effects of different volume patterns with similar rest periods on lactate production are yet to be evaluated.

Conclusion: It was concluded that the blood lactate response depends upon the maximum absolute load lifted by the weight lifters as compared to the volume of load lifted. In other words, it can be said that blood lactate production was largely dependent on the percentage of 1RM lifted.

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Visual Response Time & Visuospatial Intelligence Scores of Athletes & Nonathletes

Kumar*, Ashok and Vishal
Department of Sports Science, Punjabi University Patiala [Punjab] India
*Email: akashokin@gmail.com

Abstract

Aim: To compare sports-related visual abilities - hand-eye response time and visuospatial intelligence of athletes to nonathletes. *Materials & Methods:* Differences in sports-related visual abilities such as hand-eye response time and visuospatial intelligence between athletes and nonathletes were studied in 30 boys (age-14.9±1.8 years) and 30 girls (age-14.3±1.6 years) school students. Visuospatial intelligence was assessed with Cattel's Culture Fair Intelligence Test. A random stimulus presentation and response recording was used for eye-hand response time with the help of audio-visual response time equipment. *Results:* Athletes had statistically significantly ($p<0.001$) lower eye-hand visual response time (i.e. the faster) and higher visuospatial intelligence compared to nonathletes. There were no statistical significant sex differences. A negative correlation was observed between the number of years of doing sports and eye-hand visual response time ($r=-0.78$, $p<0.001$) and a positive correlation with visuospatial intelligence ($r=0.69$, $p<0.001$). *Conclusion:* The results of the present study support the view that participation in different sport activities is beneficial to both eye-hand response time and visuospatial intelligence. Keeping in view the results of the present study, we can recommend more sport activities for higher academic achievement in primary, middle, high and senior secondary school students.

Key Words: Response time, Visuospatial Intelligence, Athletes

Introduction

Visual performances are found to be significantly better in athletes as compared to nonathletes for certain visual skills such as visual reaction time and peripheral awareness. It has also been reported that the dynamic visual perception of athletes is superior to that of nonathletes and athletes are reported to be quicker than non-athletes *(Ishigaki & Miyao, 1993)*. It has also been revealed that exercise shortens motor time *(Davranche et al, 2006)*. In a recent study, differences between athletes and the sedentary subjects in terms of visual evoked potentials (VEP) have been reported; acute and habitual exercise affect the visual evoked potentials responses independently of the body temperature and other physiological variables *(Ozmerdivenli et al, 2005)*. They suggested that small sized pre exercise P100 amplitudes in the athletes can be attributed to the effect of rapid visual-activity challenging sports on the central nervous system. *Eysenck (1986)* has re-emphasized the intelligence concept and pointed out the significance of reaction time as a basic measure of intelligence: the speed of information processing is a basic property of biological intelligence (the "speed hypothesis of intelligence"). Accordingly, the nonverbal IQ has been found to be directly correlated with hand

speed in right- and left-handed subjects *(Tan 1992)*. The aim of the study was to compare hand-eye reaction time and visuospatial intelligence of athletes to those of nonathletes.

Materials and Methods

Subjects- All the subjects participated in the study voluntarily. There were 30 boys and 30 girls attending high & senior secondary schools in the district of Patiala, Punjab. They ranged in age from 15 to 19 years. Of 30 boys, 5 were football players, 5 were basketball players, 5 were volleyball players and 15 were nonathletes. Five of the 30 girl subjects were basketball players, 5 were volleyball players, 5 were runners and 15 were nonathletes. Athletes were members of school teams playing various sports. Athletes who played for less than 3 years in any sport were not included in the study. Subjects with visual field defects were not included in the study.

Experimental design- All of them were right-handed. Left-handed subjects were not recruited to rule out of having an advantage in reaction time *(Dane & Erzurumluoglu, 2003)*. For the assessment of eye-hand visual response time, a random visual stimulus presentation and response recording was used with the help of audio-visual response time instrument, that is, 'Response Analyzer' which had a display accuracy of 0.001 second. The instrument is specially designed to measure response time in milliseconds. All the subjects were given practice trials with the stimuli to acquaint them with the operation of the apparatus. They were instructed to react as quickly as possible on every trial. Every subject used the right hand in responding to the visual stimulus. Every stimulus presentation was preceded by the investigator's calling "ready". The average of the three readings was taken as the value for response time task. Response times shorter than 150 ms were considered anticipatory responses and those longer than 500 ms were considered attention errors. Both were removed from the analyses. The visuo-spatial intelligence (nonverbal intelligence) was established by Cattel's Culture Fair Intelligence Test. The raw scores were converted into IQs using the table for converting raw scores directly into intelligence quotients (IQ).

Statistical analysis: For descriptive & inferential statistical analysis, the mean, standard deviation, unpaired Student's t test and Pearson correlation in the statistical software SPSS version 16.0 for Windows were used.

Results & Discussion

Table1: Mean±SD of eye-hand visual response time & nonverbal intelligence in young athletes & nonathletes

	Athletes	Nonathletes
Eye-Hand Visual Response Time	**318.1 ±48.8**	**369.4 ±60.1****
Boys	**317.1 ±49.9**	**366.8 ±58.5****
Girls	**320.3± 46.5**	**371.3± 63.0****
Nonverbal Intelligence	**77.4 ±23.6**	**70.3 ±18.6****
Boys	**75.8 ±21.2**	**69.2± 17.7***
Girls	**81.0 ±28.1**	**71.2± 19.4***

Application of ANOVA revealed that there was not any difference for eyehand visual response time and visuo-spatial intelligence among different sports. In the present study, it was found that there were differences in eye-hand visual response time and visuo-spatial intelligence scores between athletes and nonathletes. Eyehand visual response time was higher in non-athletes on the other hand visuo-spatial intelligence was higher in athletes. These differences were not affected by sex (Table 1). In the total sample, there was a negative correlation between the sporting

age (that is total duration of playing sports) and eye-hand visual response time ($r=-0.78$, $p< 0.001$) and a positive correlation with visuospatial intelligence ($r=0.69$, $p< 0.001$).

Discussion

It has been well documented that exercise is beneficial to mental health *(Salmon, 2001)*. Researchers have also established that exercise results in a mild enhancement of cognitive function *(Colcombe & Kramer, 2003 and Tomporowsk, 2003)*. According to a recently suggested theory, the "psychomotor theory", there is a relationship between exercise and mind health, and dance is the aesthetic expression of mind in bodily movement *(Tan, 2007)*. Dance originates in a discrete bodily-kinesthetic "intelligence" *(Gardner, 1993);* skilled movement is a form of thinking *(Fischer & Bidell, 1998);* movement is predominant in all forms of human intellectual activity *(Laban & Lawrence, 1974)*. The exercise has also been reported to have antidepressant and tranquilizing effects on the participants *(Berger, 1984)*. *Tan (2007)* suggested that movement may occupy a central position in cognitive actions. Accordingly, *Tan (1991)* reported that there is an inverse correlation between the latency of the Hoffman Reflex recorded from the thenar muscles of the right and left hands and nonverbal IQ: high IQ was associated with higher motoneuronal excitability and vice versa. Concerning the more peripheral nervous system, *Tan (1992)* found that the sensory and motor median-nerve conduction velocity was positively linearly correlated with the IQ in men. IQ is closely related to spinal-motor activity, assessed by Hoffmann reflex in humans *(Tan, 1989b)*, and to the hand skill in right- and left-handed subjects *(Tan 1989a & 1989b)*. In this study, eye-hand visual reaction time was higher in non-athletes ($p<0.001$) and visuospatial intelligence was higher in athletes ($p< 0.01$). Sex did not significantly affect these differences. Two possible explanations for the athlete's advantages in both eyehand visual reaction time and visuospatial intelligence are that subjects with intrinsic neurological advantages such as eye-hand reaction time and visuospatial intelligence can readily participate in sports, and that exercise is beneficial to eye-hand reaction time and visuo-spatial intelligence. In the total sample, there was a negative correlation between the sporting age (that is total duration of making sports) and eye-hand visual reaction time ($p<0.001$) and a positive correlation with visuospatial intelligence ($p<0.001$). These results support the view that exercise is beneficial to eye-hand reaction time and visuo-spatial intelligence. It can be stated that sport activities can be recommended for success in the academics such as mathematics and science in primary, middle, high and senior secondary school students. Moreover, it can be stated that all sports are beneficial for the enhancement of cognitive function *(Colcombe & Kramer, 2003 and Tomporowsk, 2003)* because there was not any difference among different sports mentioned in this study such as football, basketball, volleyball, and running.

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Biological Maturity of Injuries Sustained due to Causes among Football Players

Singh, Shinku Kumar, Assistant Professor, Department of Physical Education, Swami Ramanand Teerth Marathwada University, Nanded Maharashtra India email: shantanu.halder93@gmail.com

Abstract

The primary aim of the present study was to compare the incidence of injuries sustained due to causes among three groups of competitive football players. The investigator has made an attempt to classify or define the groups of football players based on the aged of the football players. Accordingly three groups of football players were targeted; Junior, Young and Senior groups football players aged between 14 to 30 years. The investigator personally contacted the players and the purpose of the study was explained to them. Further instructions were given by the investigator to the players for the completion of questionnaire. A questionnaire prepared by Cromwell & Gromely (2000) for elite Gaelic football players and modified by the investigator was used. The information of injuries was collected from 685 elite football players of three groups. Total 480 injuries out of 388 football players were found out over the one year of the period. Means, Standard deviations, one way analysis of variance and post hoc test were utilized to compare the incidence of injuries among three groups of football players. The result reveals that there was statistically significant difference of incidence of injuries with respect to causes found in Stumble (F=6.68,<.05) and Tackle (F=13.30,<.05) However, there were insignificant difference of incidence of injuries found in Collision (F=.90), Running (F=.1.25), Contact with Ball (F=1.93), Foul play (F=0.25), Twist (F=2.23) and Kicking the Ball (F=0.75).

Key words: Health related physical fitness, reaction ability, Rural, Urban

Introduction

Football is a high risk sport dominated by overuse injuries while recovery time from injuries is relatively long, but only a few working days are lost by the players to return back to play, thus leading to abuse of the injured sites. In football only a few studies have been made in the literature regarding incidents of injury and pattern, possible risk factors and injury prevention *(Griffith, 1989; Wastan, 1993; Junge, 2000)*. In football overuse injuries are the most frequent incidences of injury; and injuries are traditionally divided into contact and non contact causes in which case contact refers to players contact. Some of the forces involved in a non contact injury are transmitted from the playing surface to the injured body part. *(Orchard et al, 2001)*

Injuries in football normally occur due to physical contacts. Even though injuries in football are driven by several factors, factors such as the physical and the lack and/or improper physical preparation, the violence and harsh playing style of the opponents, Injuries in sport activities can occur for many reasons such as stumble, tackle, running, foul play and collision. (*Cromwell & Gromely, 2000)* No matter how safe the environment or how well conditioned the athlete is will sometimes inevitably produce some

injuries, whether it is by contact with other bodies or by psychological factors as reported in various studies. Soccer entails physical contact in the course of tackling or contesting possession of the ball with opponents and this inevitably leads to injury of varying severity. A majority of injuries are unintentional, resulting from an error may lead to an accident and some of these accidents lead to injuries. The present study deals with comparison of injuries accoroding to biological maturity among three groups of competitive football players. The investigator has made an attempt to classify the football players based on the aged group.

Materials and Methods

Keeping in view the objective of the study, three groups of football players were targeted. Junior, young and senior group football players aged between 14 to 30 years. The data was collected with the help of questionnaires reported by *Cromwell & Gromely, (2000)* for Elite Gaelic football players. The subjects were required to fill out a questionnaire for each injury for one year. The information of injuries was collected from 685 football players of three groups and a total of 480 injuries out of 388 football players were found out over the period of one year to explore and measure the injuries incidence in the three group of football players. The groups are junior (aged14-18), Young (aged19-24) and senior (aged 25-30) groups football players. This study aims to compare the Injuries among these three groups who are playing in the same sports.

Research Design: The design in a research study refers to "the researcher's overall plan for answering the researcher's question or testing the research hypotheses. This study involves a comparative survey of three groups of football players in a non-experimental, retrospective study design.

Statistical analysis: The Statistical Package for the Social Sciences (SPSS; version 18.0) was used for the data analysis. One Way Analysis of Variance and post hoc test were used to assess overall differences of injuries among three groups.

Results & Discussion

Table-1: Mean scores and Standard Deviations of incidence of injuries with respect to causes among three groups of football players

Sr. No	Causes	Football players	N	Mean Score	SD
1	Collision	Young	22	1.18	0.39
		Junior	35	1.05	0.35
		Senior	08	1.12	0.37
2	Foul Play	Young	39	1.10	0.36
		Junior	41	1.17	0.39
		Senior	03	1.00	0.32
3	Running	Young	39	1.25	0.41
		Junior	33	1.12	0.37
		Senior	05	1.00	0.32
4	Contact with Ball	Young	13	1.46	0.48
		Junior	16	1.06	0.35
		Senior	02	1.00	0.32
5	Stumbling	Young	17	1.50	0.38
		Junior	19	1.10	0.36
		Senior	08	1.00	0.32
6	Tackl-ing	Young	27	1.18	0.39
		Junior	19	1.10	0.36
		Senior	06	1.00	0.32
7	Twisting	Young	09	1.11	0.37
		Junior	12	1.00	0.32
		Senior	02	1.00	0.32
8	Ball Kick-ing	Young	23	1.13	0.37
		Junior	15	1.00	0.32
		Senior	03	1.00	0.32

Table-1, indicates the mean scores and standard deviations of incidence of injuries due to causes among three groups of competitive football players.

The mean scores (S.Ds.) of injuries sustained due to Collision of young football players were 1.18 (0.39), junior group football players were 1.05 (0.35) and senior group football players

were 1.12 (0.37). The mean scores (S.Ds.) of injuries sustained due to Foul Play of young football players were 1.10 (0.36), junior group football players were 1.17 (0.39) and senior group football players were 1.00 (0.32). The mean scores (S.Ds.) of injuries sustained due to Running of young football players were 1.25 (0.41), junior football players were 1.12 (0.37) and senior football players were 1.00 (0.32). The mean scores (S.Ds.) of injuries sustained due to Contact with Ball to young group football players were 1.46 (0.48), junior group football player were 1.06 (0.35) and senior group football players were 1.00 (0.32). The mean scores (S.Ds.) of injuries sustained due to Stumble of young group football players were 1.50 (0.38), junior football players were 1.10 (0.36) and senior football players were 1.00 (0.32). The mean scores (S.Ds.) of injuries sustained due to Tackle of young football players were 1.18(.39), junior football players were 1.10 (.36) and senior football players were 1.00 (.32). The mean scores (S.Ds.) of injuries sustained due to Twist of young football players were 1.11(0.37), junior football players were 1.00 (0.32) and senior football players were 1.00 (0.32) and the mean scores (S.Ds.) of injuries sustained due to Kicking the Ball of young football players were 1.13 (0.37), junior football players were 1.00 (0.32) and senior football players were 1.00 (0.32).

In order to find out the significant difference of incidence of injuries among three groups of competitive football players; ANOVA was applied the results of which are presented in Table 2.

Table – 2: One way Analysis of Variance of incidence of injuries sustained due to causes among three groups of football players.

Sr. No.	Causes	Source of Variance	DF	SS	MSS	F-ratios
1.	Collision	Between groups	02	0.20	0.10	0.90^{NS}
		Within groups	62	07.04	0.11	
2.	Foul Play	Between groups	02	0.15	0.07	0.25NS
		Within groups	80	23.35	0.29	
3.	Running	Between groups	02	0.50	0.25	1.25NS
		Within groups	74	14.96	0.20	
4.	Contact with Ball	Between groups	02	1.24	0.62	1.93^{NS}
		Within groups	28	9.16	0.32	
5.	Stumble	Between groups	02	2.14	1.07	6.68*
		Within groups	41	6.94	0.16	
6.	Tackle	Between groups	02	6.92	3.46	13.30*
		Within groups	44	11.86	0.26	
7.	Kicking the Ball	Between groups	02	0.18	.09	0.75^{NS}
		Within groups	38	4.60	0.12	
8	Twist	Between groups	02	0.28	0.14	2.23NS
		Within groups	20	1.24	0.06	

*** Significant at .05 level, NS = Not Significant**

Table 2 shows the, Analysis of Variance of incidence of injuries sustained due to causes among three groups of football players. In order to find out the difference of incidence of injuries with respect to causes among three groups of competitive football players. F-ratio was computed for each cause separately. The data given in Table 2 shows that there was statistically significant difference of incidence of injuries with respect to causes found in Stumble (F=6.68,<.05) and Tackle (F=13.30,<.05) However, there were insignificant difference of incidence

of injuries found in Collision (F=.90), Running (F=.1.25), Contact with Ball (F=1.93), Foul play (F=0.25), Twist (F=2.23) and Kicking the Ball (F=0.75).

In order to locate the incidence of injuries due to stumble among three groups of competitive football players; Scheffe post hoc test was applied to compare the incidence of injuries; Table 3 shows the possible comparisons for three group means.

Table – 3: Scheffe post hoc Statistically Comparison for mean difference of incidence of injuries due to stumble among three groups of competitive football players.

Mean Scores				
Junior	**Young**	**Senior**	**Mean difference**	**C.D. at 5% level**
1.10	**1.50**		**0.40**	**0.42**
1.10		**1.00**	**0.10**	**0.36**
	1.50	**1.00**	**0.50**	**0.42 ***

**** Significant at .05 level.***

Table 3, reveals that (i) insignificant difference of incidence of injuries was found between junior and young group football players sustained due to stumble. (ii) Insignificant difference of incidence of injuries sustained due to stumble was found between junior and senior group football players. (iii) Significant difference of incidence of injuries sustained due to stumble was found between young and senior group football players. Young group football players reported maximum injuries sustained due to tackle as compare than senior football players.

As per Table 4, shows that the Scheffe post hoc statistical comparison for mean difference of incidence of injuries due to tackle among three groups of competitive football players.

Table: 4: Scheffe post hoc Statistically Comparison for mean difference of incidence of injuries sustained due to tackling among the three groups of competitive football players.

Mean Scores				
Junior	**Young**	**Senior**	**Mean difference**	**C.D. at 5% level**
1.10	**1.18**		**0.08**	**.16**
1.10		**1.00**	**0.10**	**.18**
	1.18	**1.00**	**0.18**	**.17***

**** Significant at .05 level.***

Table 4, reveals that (i) No statistically significant difference of incidence of injuries was found between junior and young groups football players sustained due to tackling. (ii) No Statistically significant difference of incidence of injuries sustained due to tackle was found between junior and senior groups football players. (iii) Significant difference of incidence of injuries sustained due to tackling was however found between young and senior groups football players. Young group of football players reported greater injuries sustained due to tackling as compared to the senior football players.

Discussion

Injury is a common phenomenon in the game of football. Injuries can occur in football even though everything possible is done to reduce the factors that might cause injuries. This study reveals that those football players who are directly involved in attack and defence are more likely to get injured and this study support the findings reported earlier by *Sinku (2006) and Crombell (2000)* who also reported that those football players who are directly involved in attack or defense are more likely to be injured.

Injuries that occur in contact with another player are common in football. Most of these situations occur when two or more players try to win the ball at the same time, or a player attempts to win the ball from an opponent. There are a large

number of studies that report the influence of foul play on injury rate *(Ekstrand et al, 1983b; Nielsen and Yde, 1989; Engstrom et al, 1990; Hawkins and Fuller, 1996; Luthje et al, 1996;Hawkins and Fuller, 1998b; Hawkins and Fuller, 1999, Chomiak et al, 2000; Junge et al, 2000a).* Results have shown that foul play is the cause of 16-28% of all injuries *(Nielsen and Yde, 1989; Hawkins and Fuller, 1996; Hawkins and Fuller, 1999; Junge et al, 2000a),* or 28-30% of traumatic injuries *(Ekstrand and Gillquist, 1983b; Engstrom et al, 1990).* Other studies have reported that 76-86% of the foul play injuries are caused by opponent and the rest by own foul *(Ekstrand and Gillquist, 1983b; Hawkins and Fuller, 1999),* and also reported that own foul play resulted in more serious injuries than opponent foul *(Ekstrand and Gillquist, 1983b).* In elite players contact injuries represents for 33-42% of all acute injuries *(Hawkins and Fuller, 1999; Hawkins et al, 2001).* Only *Luthje et al (1996)* found much higher proportion of contact injuries (79%). Studies on players at lower or various level reports that 55-59% of acute injures were contact injuries, while the comparable percentage for junior players was 42-53% *(Ekstrand and Gillquist, 1983a; Nielsen and Yde, 1989; Hawkins and Fuller, 1999; Ostenberg and Roos, 2000; Heidt, Jr. et al. 2000).* Tackling is the most common injury mechanism in football *(Nielsen and Yde, 1989, Luthje et al, 1996; Hawkins and Fuller, 1999).* Studies on elite players have indicated that tackling is responsible for 21-39% of acute injuries *(Luthje et al. 1996; Hawkins and Fuller 1999),* while for junior players this rate is 40-48% *(Nielsen and Yde, 1989; Yde and Nielsen, 1990; Hawkinsand Fuller, 1999).* Studies have also indicated that tackling is the most usual injury mechanism for ankle (43-67%) and knee (55%) injuries *(Nielsen and Yde, 1989; Yde and Nielsen, 1990).*

Few studies *(Sinku, 2006, 2009, & Pagare, 2009)* show that collision is the most usual mechanism for concussion, and such collisions account for an even larger proportion of concussions in female players (71-75%) than in males (47-65%) *(Barnes et al, 1998; Boden et al, 1998).* Of these, head-to-head contact has been shown to be the most common mechanism (28% of the total number of concussions), followed by head to elbow contact (14%) *(Boden et al, 1998).* A larger proportion of collisions with other objects than players occurred among male players (35-53%) than females (25-29%) *(Barnes et al, 1998; Boden et al, 1998),* and most of them occurred when a player was hit in the head by the ball. Studies report that 58-67% of acute injuries in elite male football occurred in non-contact situations, while 41-45% of acute injuries in players at lower or various level and 47-58% of acute injuries in youth players occurred in non-contact situations *(Ekstrand and Gillquist, 1983a; Nielsen and Yde, 1989; Hawkins and Fuller, 1999; Ostenberg and Roos, 2000; Heidt, Jr. et al, 2000; Chomiak et al, 2000; Hawkins et al, 2001).* Running is the most usual non-contact injury mechanism, accounting for 20-24% of acute injuries in elite players and 9-27% in youth players *(Yde and Nielsen, 1990; Hawkins and Fuller, 1999; Hawkins et al, 2001).* Muscle strains occur most frequently

during sprinting, especially hamstring strains *(Nielsen and Yde, 1989)*. Kicking the ball has found to be the mechanism of 9-10% of acute injuries in elite players and 8-13% in youth players *(Nielsen, 1990; Hawkins and Fuller, 1999)*. Finally, the most important usage of this research is to prevent the incidence of subsequent injuries by identifying injured athletes and to provide preventive strategies.

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A Study of Nerve Conduction Properties in Labourers

Jagga[1], V., Verma[2], S.K. and Lehri[3], A.
Head, Department of Physiotherapy, Prem Physiotherapy & Rehabilitation College, Panipat, Haryana
[2] Professor (Retd)., Dept. of Sports Science, Punjabi University, Patiala-147001, Punjab
[3]Asst. Professor., Dept. of Sports Science, Punjabi University, Patiala-147001, Punjab

Abstract

Thirty healthy male volunteers who are labourer by occupation were included in the study after their informed written consent to participate. All the participants were examined to exclude any history of orthopedic, systemic or neuromuscular disorder by relevant history taking with psychological, musculoskeletal and neurological examination. Subjects were excluded if any one of them is not fit to the inclusion criteria. A NEUROPERFECT 2000 mechine was used to check nerve conduction properties of the subjects. The study was conducted to know the nerve conduction properties of median nerve in healthy male labourer for dominant and non dominant hand. The nerve conduction properties studied for motor and sensory nerve were latency, amplitude and nerve conduction velocity of median nerve for dominant and non dominant hand of the subjects. The site of stimulation for motor median was the wrist; elbow and axial and recording site were motor point of Abductor Pollicis Brevis. The results indicate that there is no statistical significant difference in median motor nerve conduction properties as well as in median sensory nerve conduction properties of dominant and nondominant hand of labourer sample. Furthermore the MNCV and SDL of median nerve for dominant hand are lower than the reffered healthy subjects reported in earlier studies it may be due to the working requirement of handloom industry (i.e. repetitive movement) and SNAP amplitude is lower only than that reported by Shehab as he measured it from negative peak to subsequent positive peak which was different than our procedure.

Key words: Labourers, Median Nerve, Motor, Sensory, Amplitude, Latency

Introduction

An activity that serves as one's regular source of livelihood or the principal activity in life that one does to earn money is known as occupation. There are various occupations in which people are involved to earn money. Labourer is a person engaged in physical work, especially of an unskilled kind.

Nerve conductions study (NCS) is a standard procedure for the evaluation of peripheral neuropathy. In the peripheral nervous system, the nerve fibres of various diameters and functions (motor and sensory) are bundled together by the connective tissue to form nerves. NCS help in delineating the extent and the distribution of neural lesions and they distinguish two major categories of peripheral nerve diseases: demyelination and axonal degeneration *(Kimura, 1984)*. The Increased use of NCS in clinical trials and research, and attention to quality in health care has heightened interest in the reliability of results. The results may be used as a basis for diagnosis and in pre-placement examinations for work restrictions, such as those related to carpal tunnel syndrome (CTS). A variety of tests

may be performed to detect sensory abnormalities, which are typical findings in early stages of disease. The nerve conduction velocity is the speed at which an electrical stimulus passes through the nerves. The motor nerve conduction velocity (MNCV) is performed by the electrical stimulation of a peripheral nerve and by using the recording from a muscle which is supplied by this nerve. The time it takes for the electrical impulse to travel from the stimulation site to the recording site is measured. This value is called the latency and it is measured in milliseconds (ms). The size of the response called the amplitude is also measured. The motor amplitudes are measured in millivolts (mv). Nerve conduction studies are influenced by number of physiological and technical variables *(Gassel, 1964, Simpson, 1964)* such as standardized measurements, temperature, height, the gender and the age of normal healthy individuals and parameters like the nerve diameter and myelination. *Stetson et al (1992)* showed that in randomly selected adults without an occupational exposure to high forces or repetitive hand exertions, the age, height, and the index finger circumference were found to be important predictors of the median, ulnar, and the sural nerve conduction measures *(Stetson et al, 1992)*. Although methods for evaluating nerve function have evolved since the 1940s, but the reliability has rarely been assessed and particularly among workers. Many studies have been published from the Western countries regarding normative data for the nerves of the upper and lower limbs *(Kimura, 1986, Perez et al, 1986, Falco et al, 1992, Hennessey et al, 1994)*. To the best of our knowledge no study has been performed on factory setup labourers in India, The primary purpose of this study is to provide electrophysiological data for commonly tested Median nerve in normal healthy labourers using standard distance, procedure and controlled temperature.

Material and Methods

Thirty healthy male volunteers who are labourer by occupation were included in the study after their informed written consent to participate. All participants were examined to exclude any history of orthopedic, systemic or neuromuscular disorder by relevant history taking with psychological, musculoskeletal and neurological examination. Subjects were excluded if any one of them is not fit to the inclusion criteria. A Neuroperfect 2000 mechine was used to check nerve conduction properties of the subjects. Nerve conduction studies were performed using standard techniques of supramaximal percutaneus stimulation with a constant current stimulator and surface electrode recording on both extremities of each subject. The nerve conduction properties studied for motor and sensory nerve were latency, amplitude and nerve conduction velocity of median nerve for dominant and non dominant hand of the subjects. The site of stimulation for motor median was the wrist; elbow and axial and recording site were motor point of Abductor Pollicis Brevis. The reference electrode was placed 4 cm distally over the 1st metacarpo-phalangeal joint for median nerve. For sensory nerves, antidromic study was done using ring electrode. Electrodes were placed on index for median nerve. Sensory nerve action potential (SNAP) amplitude was taken from peak to base. Ground electrode was

placed between stimulation and recording electrode.

Results

30 healthy male labourer volunteers included in the study were aged 20-45 years with mean age of 31±7.2 years. The height of the volunteers ranged from 150-175 cm with mean height of 160.9 ±8.20 cm.

Table 1 Morphological Characteristic of male labourers

	AGE, YRS	HEIGHT, CMS	WEIGHT, KG	BMI
Mean±SD	31 ±7.2	160.9 ±8.20	57.93 ±9.27	22.18 ±2.42

The weight of the volunteers ranged between 48 to 88 kg with mean weight of 57.93±9.27kg. The BMI of selected volunteers was 22.18. On an average all the subjects were found to possess normal height, weight and normal BMI.

There is no statistical significant difference in median motor nerve conduction properties as well as in median sensory nerve conduction properties of dominant and nondominant hand of labourer sample.

Table 2: Comparison of nerve properties of the dominant & non dominant hands in the subjects.

DOMINANT HAND				NON DOMINANT HAND			
Sr.No.	Nerve	Properties		Sr.No	Nerve	Properties	
1	Median Motor	Latency (msec)	3.09±0.50	1	Median Motar	Latency (msec)	2.96±0.46
		Amplitude(mV)	13.28±5.39			Amplitude(mV)	13.05±5.33
		N.C.V (m/s)	51.30±4.51			N.C.V (m/s)	52.54±7.03
2	Median Sensory	Latency (msec)	2.29 ±1.01	2	Median Sensory	Latency (msec)	2.44 ±1.17
		Amplitude (μV)	38.33 ±25.36			Amplitude (μV)	39.35 ±31.2
		N.C.V (m/s)	53.54 ±16.30			N.C.V (m/s)	51.00 ±15.86

Discussion:

This study examined the nerve conduction parameters of the most commonly tested nerve i.e Median nerve in the upper limb of a healthy adult population of labourer working in handloom industry of Panipat, Haryana. A comparison was made between this study and other studies published in the literature for healthy individuals that used dominant hand, standardized techniques and recorded limb temperature of the subjects *(Kimura, 1986, Robinson et al, 1993, Hennessey et al, 1994, Shehab, 1998, Mishra, & Kalita, 2006)* were chosen. The results of this study for the motor nerve conduction parameters of the median nerve were in accordance with those of other studies, has been seen in table no. 3

Table 3: Comparison of Nerve conduction parameters-

	Present Study (N = 30)	*Mishra & Kalita, 2006.* (N = 26)	*Shehab, 1998.* (N = 50)	*Hennessey et al, 1994.* (N = 44)	*Robinson et al, 1993.* (N = 44)	*Kimura, 1986.* (N = 61)
Motor Median						
Latency(msec)	3.09±0.50	3.77 ± 0.4	3.1 ± 0.3	3.2 ± 0.4	3.6 ± 0.4	3.49 ± 0.34
Amplitude(mV)	13.28±5.39	8.10 ± 2.62	11.1 ± 2.8	12.1 ± 3.8	9.5 ± 2.9	7.0 ± 3.0
N.C.V (m/s)	51.30±4.51	58.52 ± 3.76	56.5 ± 3.5	59.5 ± 4.4	54.4 ± 3.8	57.7 ± 4.9
Sensory Median						
Latency(msec)	2.29 ±1.01	3.06 ± 0.41	2.3± 0.3	2.5 ± 0.2	3.7 ± 0.3	2.84 ± 0.34
Amplitude(μV)	38.33 ± 25.36	8.91 ± 4.48	63.3± 18.9	31.4 ± 8.2	35.6± 11.8	38.5 ± 15.6
N.C.V (m/s)	53.54 ±16.30	45.45 ± 9.4	56.6± 7.6	61.2 ± 4.3	54.6± 3.7	56.2 ± 5.8

The result for Latancy of the present study is in accordance with previous studies done by *Shehab (1998)*. Amplitude of the present study is higher than the compared studies but values significantly differ from study done by *Mishra & Kalita (2006)* and *Kimura (1986)*. Conduction velocity of the sample is in accordance with *Robinson et al (1993)* but lower than reported for other studies *(Hennessey et al, 1994, Kimura, 1986, Shehab, 1998 and Mishra, & Kalita, 2006)* it may be due to repetitive movement of wrist as per their job requirement.

Sensory Latancy of the study is lesser than all but significantly differ from the results of *Hennessey et al (1994)*. SNAP amplitude that we recorded was measured from peak of negative potential to base line in accordance with other studies *(Hennessey et al, 1994, Kimura, 1986, and Robinson et al, 1993)*. However, Shehab (9) measured it from negative peak to subsequent positive peak. This might be the reason why we got lesser SNAP amplitude. The result for conduction velocity for the present study is in accordance with all the referred researchers.

Thus, the values for the nerve which was tested, agreed with those of most of the other researches, while a few nerve parameters showed considerable differences. This difference between the results of the present study and the data which has been published in the literature could be attributed to a variety of causes. Firstly, the difference in the distance between the stimulating and the recording electrodes and the muscles which were tested, inflicted well on the lower values. Secondly; the age of the subjects who were studied. Thirdly, the diversity of the methods and techniques (the studies differed in the setting and the recording of the electrical responses, and the equipment which was used). Finally, the type of electrode which was used could also be a source of this variation. Besides, different studies were done on different ethnic groups. Some studies were done on Caucasian subjects and others were done on Asians.

At present it is difficult to attribute the differences to a single factor. On the other hand, the diversity could have resulted for variables that were not yet considered by researchers such as body built and climatic dwelling conditions.

Conclusion: The study was conducted to know the nerve conduction properties of median nerve in healthy male labourer for dominant and non dominant hand. The study concluded that there is no significant difference in the values of nerve conduction properties of dominant and non dominant hand of the healthy sample ; furthermore the MNCV and SDL of median nerve for dominant hand is lesser than the reffered healthy subjects studies it may be due to the working requirement of handloom industry(i.e. repetitive movement). and SNAP amplitude is lesser only than Shehab as he measured it from negative peak to subsequent positive peak which was different than our procedure.

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A Survey of Professionally Qualified Physiotherapist Working in Neonatal and Paediatric Intensive Care Units in Punjab

Kumar[1], Ashok, Shergill[2], Navkaran & Jairaman[3]
[1]Assistant Professor, Department of Sports Science, Punjabi University Patiala (Punjab) India
[2]Ph.D. Student, Dept. Sports Science, Punjabi University Patiala (Punjab) India,
mail:navkaran9999@gmail.com.
[3]Assistant Professor, Department of Physiotherapy, Punjabi University Patiala (Punjab) India

Abstract

The purpose of this study was to observe the practice of physiotherapy in Neonatal and Paediatric Intensive Care Units (NICU and PICU) in Punjab state. The design of the study was exploratory cross sectional survey. Data was collected with the help of standardized questionnaire, which was sent to one hundred thirty therapists who worked in thirty eight different hospitals in Punjab and these hospitals have claimed physiotherapy facilities in their NICU and PICU premises. A period of two weeks was given to the therapists for the completion of questionnaire. If the therapists were not able to send the filled questionnaire within two weeks, then a reminder call was given to them for the next two consecutive weeks. It was found that only eighty-four (i.e. 64.61%) completed questionnaires was received from the twenty five hospitals. Results revealed that 60% of hospitals were having physiotherapists and out of which 51.2% therapists were graduate in nursing (B.Sc.), 41.7% graduate in physiotherapy (BPT) and 7.1% Master in Physiotherapy (MPT). It was concluded that not all of the patients get routine physiotherapy from the professionally qualified physiotherapists as part of their NICU and PICU stay in hospitals located in Punjab.

Key words: ICU, Neonatal, Paediatric, Physiotherapy, Punjab

Introduction

Recent advances in medical care have improved the survival of newborn babies born with various problems. Despite this death in the neonatal intensive care unit (NICU) is an inevitable reality. In 1960, the idea of having a special intensive care unit for newborns, a neonatal intensive care unit represented a developmental milestone for the field of neonatology. Neonates as young as 25 weeks and as small as 750 g are routinely being saved. However, survivors often have significant physical and mental impairments, including cerebral palsy, blindness, and learning disabilities *(Manjiri et al., 2011)*. The infant mortality rate (IMR) in India has dropped from 144 per thousand live births to 84 per thousand live births in the past few decades. In Punjab according to the 2011 census infant mortality rate is 38 per thousand live births. The recommendation is for 30 Neonatal intensive care units beds per million population *(Fernandez and Mondkar, 1993)*. Neonatal chest physiotherapy has become a routine method of care in neonatal intensive care units in western world *(Bruno & Claude, 2007)*, while the same is less common in India, probably due to shortage of cardiopulmonary physiotherapy training in pediatrics and neonates.NICU is a unit that provides high quality skilled care to critically ill neonates

by offering facilities for continuous clinical, biochemical and radiological monitoring and use of life support systems with the aim of improving survival of babies *(Fernandez and Mondkar, 1993)*. NICU is typically directed by one or more neonatologists and staffed by nurses, nurse practitioners, pharmacists, physician assistants, resident physicians, and respiratory therapists *(Whitfield et al, 2004)*. Pediatric intensive care unit is an area within a hospital specializing in the care of critically ill infants, children, and teenagers. A PICU is typically directed by one or more pediatric intensivists or PICU consultants and staffed by doctors, nurses, and respiratory therapists who are specially trained and experienced in pediatric intensive care. The unit may also have nurse practitioners, physician assistants, physiotherapists, social workers, child life specialists, and clerks on staff although this varies widely depending on geographic location. The ratio of professionals to patients is generally higher than in other areas of the hospital, reflecting the acuity of PICU patients and the risk of life-threatening complications (*Pronovost et al, 2001)*.

Physiotherapy is sought when there is excess secretion, poor gas exchange, and increased work of breathing or radiologic evidence of atelectasis *(Vijay et al., 2012)*. Children should be handled with care and respect, most physiotherapy techniques used in adults can be applied in children and the same contraindications apply. The role of physiotherapist in the NICU has been associated with the care of neonate lung. Postural drainage with percussion, vibration and suction are incorporated in physiotherapy management. In some institutions around the world extubations are also performed by physiotherapists in accordance with the neonatal unit protocol. In addition to respiratory care, the physiotherapists are also engaged in assessment and management of neonates with either neurological or musculoskeletal disorders *(Bertone, 1988)*. The role of physiotherapist in the neonatal intensive care unit and pediatric intensive care units are positioning, postural drainage, percussion, vibration, suctioning, breathing exercises, forced expiratory techniques, application of aerosols, nebulisation and bronchodilators *(Robyn and Robyn, 2003)*.The basic therapeutic principles in paediatric chest physiotherapy techniques (CPT) are identical to those applied in adults. However, the child's growth and development results in continuing changes in respiratory structure and function and the requirement for different applications of CPT in each age group *(Zach and Oberwaldner, 1999)*. The objectives of CPT are to prevent or reduce the mechanical consequences of obstructing secretions, such as hyperinflation, atelectasis, maldistribution of ventilation, ventilation/perfusion mismatch and increased work of breathing. Another therapeutic concept focuses on removing infective material, inflammatory mediators, and proteolytic and oxidative activity from the airways and in doing so reduces or even prevents host-mediated inflammatory tissue damage *(Zach and Oberwaldner, 1987)*. The most common referred conditions for physiotherapy are hyaline membrane disease (HMD), meconium aspiration, pneumonia, and surgery involving the thorax and abdomen.

The most common cause of respiratory distress in the neonate is HMD which is related to insufficient levels of surfactant in the lung *(Farrell and Avery, 1975)*. The physiotherapy techniques are beneficial in patients with pneumonia and compromised airway clearance, especially in the clearing stages of infectious process. The purpose of this study was to find whether the NICU and PICU located in Punjab state provide physiotherapy facilities to the intensive neonates and paediatric populations.

Material and Methods:

The design of the present study was exploratory cross sectional survey. The participants of the present study were physiotherapists and nurses who were working in NICU and PICU.They were requested to fill the questionnaire. A list of hospitals of Punjab state was obtained from the website of Govt. of Punjab, Department of Family and Health Welfare Society and also from various paediatricians across the state. Following which data collection was started from various hospitals and nursing homes in Punjab. The hospitals in Patiala district and nearby towns were personally visited by the investigator and data was collected from the therapists who were worked in NICU and PICU. A questionnaire to the hospitals located in other districts of Punjab was sent either by e-mails or personally by fellow colleagues. The investigator did not get the opportunity to meet every therapist personally. Two weeks time was given to the respondents to fill the questionnaire and after that a reminder call was given to them after consecutive one week. The aim and objectives of the study were clearly stated in a cover letter attached to the questionnaire in order to obtain the consent of respondents. The respondents were made clear that the information gathered from them shall remain confidential and be used only for research purpose. Some therapists filled the questionnaire immediately whereas others asked the investigator to leave the blank questionnaire and collect the filled one at a later date. The investigator distributed the questionnaire to 130 therapists. Repeated requests were made to them regarding to fill the questionnaire two times after 2 weeks. Even after repeated requests made to the respondents, 46 questionnaires was not obtained and only 84 filled questionnaires were collected. Thus the response rate of this survey was 64.61%.

Data analysis- Data was summarized using percentages and tabular forms and graphs.

Results & Discussion

A total of 84 completed questionnaires were received out of 130 (64.61% response rate) with largest response from Patiala, Mohali, Bathinda, Ludhiana, Muktsar in descending order.

Table 1. Hospitals with & without physiotherapists

Hospitals	N	%
with physiotherapists	15	60%
without physiotherapists	10	40%

Table 1 shows that the number and percentage of hospitals with and without physiotherapists, 15 (60%) hospitals have permanent physiotherapists in their facility and 10(40%) were not having any physiotherapists in their facility.

Table 2. Therapists involved in initial ventilator parameters

Involvement in setting initial ventilator parameters	N	%
Regularly	**16**	**19.05%**
Often	**19**	**22.62%**
Occasionally	**24**	**28.57%**
Never	**25**	**29.76%**

Table 2 shows that how often the therapists were involved in setting initial ventilator parameters. It was found that 29.76% therapist never involved in ventilator settings, 28.57% were occasionally involved and only 19.05% therapists were regularly involved in setting of initial ventilator setting. Table 3 show that 45.24% therapists were never involved in weaning, 21.43% were regularly involved and 14.29% were occasionally involved in weaning from mechanical ventilator.

Table 3.Therapists involved in weaning from mechanical ventilator

Involved in weaning	N	%
Regularly	**18**	**21.43%**
Often	**16**	**19.04%**
Occasionally	**12**	**14.29%**
Never	**38**	**45.24%**

Table 4 shows that the academic qualifications of the therapist providing physiotherapy treatment in different hospitals. Therapists with B.Sc. nursing (51.2%) were mostly indulged in physiotherapy treatment than the qualified professionally qualified physiotherapists with bachelor and masters qualification in physiotherapy 41.7% and 7.1% respectively.

Table 4.Table showing qualification of the individuals providing physiotherapy treatment

Qualification	N	%
BPT	**35**	**41.7%**
MPT	**6**	**7.1%**
PhD	**0**	**0**
Diploma	**0**	**0**
B.Sc nursing	**43**	**51.2%**

Discussion

A total number of 48 hospitals were identified in Punjab with NICU and PICU facilities and 38 hospitals were invited for the study, out of which 25 responded. The total number of hospitals having physiotherapy facilities was (15) 60% and (10) 40% were without the physiotherapy facilities in Punjab. The investigator found very little or no considerable data regarding the role of Physiotherapy in NICU and PICU in India or any of its state and this study may be the first to report the practice of physiotherapy in NICU and PICU in Punjab state. Norrenberg *et al*, 2000, reported that 38% of hospital in Europe had more than 30 physiotherapists working in the hospital, but 25% had no exclusive ICU therapists. 34% were available during night, 85% during the weekend. In our study out of 25 hospitals 19 (76%) hospitals were having teaching facilities and 6 (24%) hospitals were without teaching facilities. In another study by Lewis *et al*, 1992, concluded that, methods of chest treatment and the indicators for commencing chest treatment were similar throughout NICU in Australia. Both physiotherapists and nursing staff played a role in chest physiotherapy in all units but in one unit it was the responsibility of the nursing staff. He reported that in 36% of units physiotherapists were only providers of the respiratory therapy and 55% of units shared respiratory therapy between nurses and physiotherapists. In our study the qualification of the individuals providing physiotherapy treatment was also similar in many aspects with the study of Robyn *& Robyn (2003),* which reported that

Respiratory therapy was carried out by physiotherapists and nurses in 54.5% of units, by physiotherapists only in 36.4% of units, and by nurses only in the remaining 9.1% of units surveyed. In our study (43) 51.2% nurses were involved in providing physiotherapy treatment and (35) 41.7% of physiotherapists were involved in providing physiotherapy care. Only (6) 7.1% postgraduate students were involved in providing treatment in NICU and PICU. *Jithendra et al. (2007),* in his study found that therapists were not involved in setting or adjusting ventilator parameters and weaning, but majority of them were involved in suctioning during extubation and some reported to be part of the weaning team. Overall response rate of the physiotherapists involved in setting ventilator parameters was 10% and respondents involved in weaning was 18%. Whereas in study by *Norrenberg & Vincent (2000)* reported that physiotherapists played an active role in the adjustments of mechanical ventilator in 12% of units, therapists were involved in weaning from mechanical ventilator in 22% of units. He also found that 25% therapists were involved in extubation and 46% were involved in implementation of non invasive mechanical ventilator. Our study showed that only 19.05% therapists were involved regularly in setting initial mechanical ventilators, 22.62% were often involved, 28.57% were occasionally involved and 29.76% were never involved in setting initial ventilator parameters. This study also showed that 45.24% respondents were never involved in weaning and only 21.43% were regularly involved in weaning. This shows that therapists are occasionally involved in other manipulations other then respiratory therapy in NICU and PICU of Punjab.

Conclusion: It was concluded that not all of the patients get routine physiotherapy from the professionally qualified physiotherapists as part of their NICU and PICU stay in hospitals located in Punjab. So, professionally qualified physiotherapists should be a part of multidisciplinary team required for physiotherapy treatment of patients.

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Hypoplasia of a Permanent Incisor Produced by Primary Incisor Intrusion: A Case Report

Verma, Leena
Sr. Asst. Professor, Dr. H.S. Judge Institute of Dental College, Punjab University. Chandigarh

Abstract

Orofacial trauma is common in atheletic children and is a serious orodental and general health problem that may have medical, esthetic and psychological consequences for children and their parents. When the root of the primary tooth is close to the unerupted permanent tooth, primary tooth trauma may result in developmental disturbances in the permanent tooth. In the present study a case report of an unusual case in which injury to the primary dentition resulted in developmental disturbances in the crown and the non eruption of the permanent tooth is presented. Localized malformation of the crown of the permanent maxillary right central incisor and enamel hypoplasia were treated with a light-cured composite resin restoration. The unerupted permanent left central incisor was removed surgically. The study also discusses the management after extraction with removable partial denture.

Keywords: Orofacial trauma Maxillary Enamel Hypoplasia

Introduction

Injuries to primary dentition are among the most common traumas that occur in the maxillofacial region; 30%–40% of all children injure at least one of their primary teeth *(Flores et al, 2007)*. Consequences of such trauma include colour changes, pulp necrosis, obliteration of the pulp canal, gingival retraction, tooth displacement, pathological root resorption, alterations in the process of normal root resorption and premature loss of the primary tooth *(Borum & Andreasen, 1998)*. Sequelae in the permanent dentition after trauma to primary dentition are usually related to intrusive injury; either the coronal or root region, or the entire permanent tooth germ may be affected *(Gondim & Moreira Neto, 2005)*. An intrusive injury occurs when the impact of an axial force displaces the tooth within the socket. Between 18% and 69% of intrusive injuries to the primary dentition cause anomalous development of the permanent teeth *(Holan et al, 2002)*. Such alterations in dental pathology can include white or yellow brown discoloration, or circular enamel hypoplasia; crown dilaceration; root duplication;vestibular or lateral root angulation or dilaceration; partial or complete arrest of root formation; sequestration of the permanent tooth germ; and disturbed eruption (Flores, 2002). Depending on the age of the child at the time of injury and the direction and severity of the trauma, force transmitted from the affected primary tooth may result in similar consequences to the underlying unerupted permanent tooth. In the following report, we present the case of a 10 year old boy in which there is uneruption and localized crown malformation of the right permanent central incisor and enamel hypoplasia in the permanent left central incisor which was caused by trauma to its preceding primary tooth while playing at play

school.This case report also discusses the management in such case .

Case Report

A 10-year-old boy came to Dr Harvansh Singh Judge Institute Of Dental Sciences ,Panjab Univeresity,Chandigarh with a chief complaint of the noneruption of right central incisor. His past dental history revealed that at 2 years of age he had injured his primary maxillary central incisors during play at play school. After the injury, he had emergency treatment that involved suturing the lip and antibiotics at a hospital, but no professional dental treatment. Other medical records revealed that he had no general pathologic condition. Clinical examination revealed that the patient had an unerupted permanent maxillary right central incisor, crown malformation and enamel hypoplasia of the permanent maxillary left central incisor. (Fig. 1).

Figure 1: Preoperative photograph of the patient showing unerupted right maxillary central incisor and hypoplastic left maxillary central incisor

Radiographic examination showed unerupted permanent right central incisor. Additional brown lines and yellow discoloration were observed on the left central incisor. Now since the unerupted permanent maxillary left central incisor was malformed and was deeply placed in the bone so it was decided to extract the teeth. The treatment plan developed included flap raising in the area of noneruption of permanent right central incisor .Two vertical shaped incisions were given in the gingiva and the flap was raised with the help of periosteal elevators. (Figure 2) On raising the flap the unerupted right central incisor was seen and extracted.

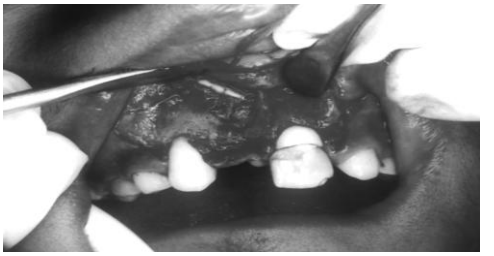

Figure 2: Figure showing exposed periosteal flap with unerupted right central incisor

Figure 3: Figure showing extraction of the unerupted central right incisor

Figure 4: Figure showing sutures placed

Figure 5: Figure showing removable partial prosthesis placed with respect to maxillary right central incisor

(Figure 3) The sutures were placed. (Figure 4) Patient was given instructions to improve oral hygiene.In maxillary left central incisor removal of the hypoplastic enamel and restoration of the region was done with composite restoration. No problems occurred during the bonding procedure, and occlusal adjustment was done. Because of the positive vitality test, endodontic treatment was not recommended. After the restoration, a periapical radiograph was taken, and the patient was followed up every 3 months. After 2 months the removal partial denture was given in maxillary right central incisor as the permanent canines of the patient were not erupted. (Figure 5).

Discussion:

An injury to a young child's teeth can be physically and emotionally traumatic. The dentist must take time to carefully examine and analyze not only the damage itself, but also the possibilities of sequelae to the permanent tooth germ and the overall health of the child. For this reason, treatment of trauma in primary dentition must include long-term follow-up of sequelae in the permanent dentition *(Cunha et al, 2001)*. The type of sequelae noted in permanent dentition can be explained in part by the age at which the trauma to the primary dentition occurred. Because the majority of traumatic injuries to primary teeth occur when children are between 1 and 3 years of age, developmental disturbances involving the crown of the permanent teeth are reported more frequently than developmental disturbances in the roots and in the eruption of permanent teeth *(von Arx, 1993)*. In the case reported here, developmental disturbances were observed in the crown of left maxillary central incisor and the non eruption of right maxillary central incisor. Formation of the permanent upper central incisor germ takes place at 20 weeks of gestation, and calcification begins when the child is 3 to 4 months of age. Depending on the severity of intrusion, intruded primary teeth can invade the follicle of the permanent germ and destroy the enamel matrix.Because ameloblasts are irreplaceable and no further cell division occurs after the completed formation of the enamel, trauma will likely arrest localized development of the crown *(Turgut et al, 2006)*. In the case reported here, the intrusive orofacial trauma to the primary left incisor that occurred when the patient was 19 months of age likely disturbed the crown formation and enamel matrix of the underlying permanent tooth, and caused changes in its colour and shape.The literature,17–19 contains a number of descriptions of the relationship between primary tooth trauma and permanent tooth hypoplasia *(Bassiouny et al, 2003, Kirchner & Jacobs, 2006)*. White discoloration is caused by the accelerated mineral deposition that results from trauma during the maturation stage of enamel development, whereas yellow-brown discoloration is caused by the incorporation of hemoglobin products from bleeding in the periapical area and enamel hypoplasia is caused by the destruction of ameloblasts in the active enamel epithelium.This trauma also caused the noneruption of permanent right central incisor. This noneruption of teeth is caused by the trauma to primary incisors which led to malformation of the crown and noneruption of the tooth. In a case similar to the one reported here, Katz-Sagi and others found crown malformation in

unerupted maxillary central incisor after trauma to the associated primary tooth *(Katz-Sagi et al, 2004).*

Conclusions

The case we report here stresses the importance of traumatic injuries to primary dentition because of their effects on the permanent tooth germ. The dentist must take time to carefully examine and analyze not only the damage itself,but also the possibilities of sequelae to the permanent tooth.

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Author name correction:

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Effect of aerobic dance on the body fat distribution and cardiovascular in middle aged women.
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Asst. Professor, Dept of Physiology, Grant Government Medical College & Sir J.J. Group of Hospitals, Mumbai 400008.
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