ISSN 0973-2020

Journal of Exercise Science and Physiotherapy (JESP)

An official Peer Reviewed Journal of Exercise Fitness & Health Alliance, EFHA
(Published biannually in June & December)

Volume 8, No. 1: 2012

Contents

EDITOR'S PAGE

Editor's Page

Journal of Exercise Science and Physiotherapy
VOLUME 8, NO.1: 2012

Exercise Fitness And Health Alliance
(Indexed with IndMed/MedINDIA a portal of Indian Medical journals)
www.efha.in

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

I am happy that the Volume 8, No. 1 issue of **Journal of Exercise Science and Physiotherapy** ***(JESP)*** is ready for circulation for the readers. This issue of JESP contains eleven articles on diverse aspects of exercise science. **Pruthi & Multani from Punjab** studied the influence of age from 25 to 75 years in North Indians on lung fuctions and concluded that lung functions significantly decline with age. **Singh & Kumar,** from Patiala, Punjab studied Lipid Profile in Type 2 Diabetic Punjabi Population and concluded that in type 2 diabetics dyslipidaemia is very common especially raised LDL levels and suggest that ethnic specific patterns of lipid profile in type 2 Punjabi diabetics regardless of their glucose levels, and further suggests that ethnic-specific strategies and guidelines on risk assessment and prevention of CVD due to dyslipidemia are required. **Mittal & Narkeesh** from Punjabi University Patiala, Punjab present a review of studies on the Effect of Stimulation of Vestibular Apparatus on Postural Muscle Tone in Cerebral Palsy. They concluded that vestibular apparatus plays an important role in maintaining postural tone and vestibular lesions results in disequilibrium with loss of postural control. This review study explains the effect of vestibular apparatus stimulation on postural muscle tone. Vestibular system plays an important role in the achievement of normal motor development and coordination. **Soodan & Kumar** from Punjab investigated the relationship among anthropometric indices (upper extremity lengths and circumferences) and motor nerve conduction velocity (MNCV) of radial & ulnar nerve (bilateral side) in aerobic trained athletes. Their results show that MNCV of right radial and left radial was negatively and significantly related with right upper arm length and left upper arm length. They further concluded that the positive relationship of MNCV of radial and ulnar nerve in aerobic trained athletes may be the result of their long term training adaptations which may be further related to their pattern of movement requirement. **Narkeesh & co-workers from Punjabi University, Patiala**, Punjab explained how surface spinal stimulation influences the monosynaptic reflex. **Vij & Multani from Punjab** compared the efficacy of Neuro- Developmental Therapy (NDT) based gait training with conventional physiotherapy in re-education of gait in post stroke hemiparetic patients. Their study has indicated that both, the conventional physiotherapy as well as addition of NDT based gait training, are effective in improving the step length, stride length, cadence, and velocity and WGS scores in post stroke hemiparetic patients. But in comparison to conventional physiotherapy alone, addition of NDT based gait training is more effective in improving step length, stride length, spasticity and WGS scores in these patients. **Pratishtha & Jagga** from Panipat, Haryana compared the effectiveness of two Mulligan techniques (TSLR and BLR that is Traction Straight Leg Raise and Bend Leg Raise) in improving the biceps femoris muscle performance, flexibility and pelvic rotation. They concluded that Mulligan TSLR stretch is more effective than BLR stretch in improving biceps femoris muscle performance, flexibility and pelvic rotation. **Gahlawat & Gahlawat from Kurukshetra, Haryana** examined the mental health dimensions between player and non- player students. They report that - male player subjects are found more positive in self-evaluation, integration of personality, autonomy and environmental mastery than male non player subjects, and in over all mental health there is significant difference between male player and male non -player subjects. **Vyas et al from Gujrat** compared the Body Composition & fitness of Gandhinagar City and Rural Boys and interestingly observed no significant differences in their body composition. **Mazumdar et al** from Faridkot, Punjab studied the effect of moderate intensity of aerobic exercise programme on exercise tolerance capacity of stable angina patients and observed increase in the exercise tolerance capacity of the stable angina patients after the completion of aerobic exercise programme. The study by **Verma from Chandigarh report** a clinical case of an aesthetic treatment in permanent teeth with localized crown malformation, enamel hypoplasia/dilacerationas as a result of traumatic injury in the primary lower central incisor. The case report stresses the importance of traumatic injuries to primary dentition because of their effect on permanent tooth germ. The investigator recommends that injured teeth should be followed up periodically for possible periapical infection and pulp necrosis. In addition special care may be necessary in the restoration of the injured teeth because their reaction pattern may be different from those of non traumatised teeth.

S.K. Verma

Influence of Age on Lung Function Tests

Pruthi[1], N., & Multani[2], N.K.
[1]PG Student, Dept of Physiotherapy, Punjabi University, Patiala-147001, Punjab
[2]Professor, Dept of Physiotherapy, Punjabi University, Patiala-147001, Punjab

Abstract

Considerable attempts have been made in the previous studies to study the significant variables affecting the standards for ventilator function including age, height, sex, size of sample tested, racial and ethnic composition, criteria for normality, tobacco smoking, environmental conditions, altitude of residence etc. The present study was necessitated as very few studies have been conducted in northern India to study the effect of age on pulmonary function tests. Study was performed on 50 subjects under the age group of 25-75 years, further divided into 5 age groups: 25-35 years, 36-45 years, 46-55 years, 56-65 years and 66-75 years. This was a cross-sectional design, which was performed in the Department of Physiotherapy. The values of all lung function tests, namely, FVC, FEV_1, PEFR, FEV_1/FVC, SVC and MVV were found to be negatively correlated with age (r = -0.446, -0.495, -0.427, -0.312, -0.392 and-0.919, respectively). It was concluded the the lung functions significantly decline with age.

Key words: lung function tests, aging, decline

Introduction

Ageing process is associated with progressive constriction of the homeostatic reserve of every organ. The most important physiological changes associated with ageing are of respiratory system depicting the decrease in static elastic recoil of the lung, in respiratory muscle performance, and in compliance of the chest wall and respiratory system, resulting in increased work of breathing *(Janssens, 2005).*

Lung functions decline throughout adult life, even in healthy persons. Cross sectional analysis have suggested that the decline may go faster after age 70. Normal aging results in changes in pulmonary, mechanics, respiratory muscle strength, gas exchange and ventilatory control. Increased rigidity of chest wall and a decrease in respiratory muscle strength with aging result in an increased closing capacity and a decreased forced expiratory volume in first second or FEV1 *(Knudson et al, 1983).*

Culver and Butler (1985) reported that lung function does not necessarily decline in the linear fashion, once thought from age 18 or 20. Rather it may reach a maximum in the late 20s and then decline, but there is variability in older adulthood depending on lung capacity at the time of lung maturation. Therefore, the present study was conducted to examine the influence of age on lung functions.

Lung function tests are carried out to assess the functioning of the lung and routinely used in clinical practice *(Verma et al, 2002).* Nevertheless, there are only a few studies that have established reference standards for pulmonary function with age, especially amongst Indian population.

Interpretation remains the least precise aspect of pulmonary function testing. Of first order is the need to understand the influence of age on Lung functions. Significant variables affecting the standards for ventilatory function include age, height, sex, size of the sample tested, racial and ethnic composition, criteria for normality, tobacco smoking, environmental conditions, altitude of residence, apparatus and techniques. Documentation and standardization of the age related changes are very difficult because of the confounding factors such as increased prevalence of disease, chronic illness, use of medication, sedentary lifestyle and difference in the physiological and chronological age. The present study has been necessitated as very few studies have been conducted in this part of the country to study pulmonary function tests in elderly healthy subjects and to see the effect of age on pulmonary function tests in elderly.

Materials & Method

The present study was performed on 50 subjects belonging to five age groups (Age group 1- 25-35 years, age group 2- 36-45 years, age group 3- 46-55 years, age group 4- 56-65 years and age group 5- 66-75 years), 10 in each group, taken from the Punjabi University, Patiala under the age group of 25-75 years. This was a cross-sectional study, which was performed in the Department of Physiotherapy. Study was performed in accordance with ethical considerations of the institute and the consent of all the participants was taken prior to the study. Before beginning with the procedure, the subjects who were selected on the basis of random sampling by applying inclusion criteria, were explained the entire procedure in detail.

The Inclusion criteria included both males and females of age group 25-75 years, smokers and non smokers, and the absence of any athletic training. The exclusion criteria included subjects with severe cardiopulmonary problem, neurological impairment, recent musculoskeletal injury and vocal cord problem.

The subjects were assessed using tools as following:

1. A spirometer (ISO certified SPIROEXCEL Medicaid system was used, giving thorough consideration to the factors enhancing accuracy of spirometric analysis and minimizing the sources of error and providing accurate information to confirm clinical diagnosis).

2. A stethoscope (An ISO certified stethoscope was used for the auscultation of bronchial sounds).

3. A weighing machine (A weighing machine with ± 100 grams accuracy was used to measure the weight of subjects in the present study.

4. A measuring tape (A 3-meter measuring tape was used for anthropometric measurement of the height of subjects)

5. A fatigue rating scale Scale *(Friedberg & Jason, 2002)* & the cigarette dependance scale *(Etter et al, 2003)* were used.

6. Scale for dyspnoea (given by the New York Association classification of breathlessness, *Pryor & Prasad, 2005*) was used.

The various statistical techniques like ANOVA, Post Hoc Analysis, Karl

Pearson Correlation were used to study the influence of age on lung function tests.

Results

Description of participants:

The demographic details of participants along with BMI, Dyspnoea and Physical Activity Level (P.A.L.) in different age groups are presented below in Table 1.

Table 1 : Mean and SD of age, BMI, dyspnoea & PAL for the subjects of different Age-Groups

Variables	25-35 YEARS		36-45 YEARS		46-55 YEARS		56-65 YEARS		66-75 YEARS	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
AGE	29.00	3.40	40.30	2.75	50.60	2.72	59.70	2.98	70.00	2.83
BMI	26.90	3.07	26.91	0.81	25.98	2.70	26.20	2.81	26.10	3.31
DYSPNOEA	1.00	0.00	1.00	0.00	1.00	0.00	1.60	0.52	2.10	0.74
Physical Activity Level (PAL)	5.10	2.28	4.60	2.91	5.40	2.41	1.80	1.14	1.50	1.08

Table 2: Mean and SD of LUNG FUNCTION TESTS for the subjects of different Age-Groups

Variables	25-35 YEARS		36-45 YEARS		46-55 YEARS		56-65 YEARS		66-75 YEARS	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FVC(lt/min)	4.44	1.15	3.48	0.43	3.25	0.86	3.07	0.81	3.17	1.04
FEV_1(lt/min)	3.75	0.77	2.96	0.36	2.90	0.78	2.54	0.57	2.68	0.76
PEFR(lt/sec)	10.18	3.78	8.36	1.37	7.35	1.57	7.11	1.17	7.65	1.35
FEV_1/FVC(lt/min)	88.82	7.93	78.10	17.52	82.59	6.07	81.49	7.57	77.17	4.98
SVC(lt/min)	5.25	1.92	3.89	0.65	4.41	1.31	3.44	0.78	3.65	1.40
MVV(lt/min)	164.70	3.16	154.90	3.87	144.90	2.56	135.10	2.60	103.70	4.50

Table 3: Comparison of mean for lung function tests between 5 different Age Groups

Variables	F value	P value
FVC(lt/min)	3.875	P < 0.05
FEV_1 (lt/min)	4.929	P < 0.05
PEFR(lt/sec)	3.514	P < 0.05
FEV_1/FVC(lt/min)	2.175	P > 0.05
SVC(lt/min)	3.113	P < 0.05
MVV(lt/min)	468.79	P < 0.05

Table 3 shows the results of comparison of mean for Lung function tests among 5 different age groups through ANOVA. It shows the calculated F value for FVC, FEV_1, PEFR, FEV_1/FVC, SVC and MVV was 3.875, 4.929, 3.514, 2.175, 3.113 and 468.79 respectively. This indicates that the difference in the mean values of FVC, FEV_1, PEFR, SVC and MVV amongst different age groups is statistically significant whereas the difference in mean value of FEV_1/FVC is not statistically significant.

Table 4: Post hoc Analysis for FVC, FEV_1 and PEFR

Multiple Comparison between age groups	FVC		FEV_1		PEFR	
	Mean diff.	Sig.	Mean diff.	Sig.	Mean diff.	Sig.
Group 1 Vs2	0.96	NS	0.78	NS	1.8	NS
Group 1 Vs3	1.18	NS	0.85	NS	2.8	NS
Group 1 Vs4	1.36	S	1.21	S	3.0	S
Group 1 Vs5	1.27	NS	1.06	S	2.5	NS
Group 2 Vs3	0.22	NS	0.06	NS	1.0	NS
Group 2 Vs4	0.40	NS	0.42	NS	1.2	NS
Group 2 Vs5	0.30	NS	0.28	NS	0.7	NS
Group 3 Vs4	0.18	NS	0.36	NS	0.24	NS
Group 3 Vs5	0.08	NS	0.21	NS	-0.29	NS
Group 4 Vs5	-0.09	NS	-0.14	NS	-0.54	NS

(S-significant, NS-non significant)

Table 4 presents multiple comparisons for the lung function tests amongst different age groups that has been interpreted from the Post Hoc analysis which shows that, mean difference in FVC is significant only between age groups 1 and 4. FEV_1 is significantly different between groups 1 and 4 & groups 1 and 5; whereas PEFR difference is significant only between groups 1 and 4.

Table 5: Post hoc Analysis for SVC and MVV

Multiple Comparison between age groups	SVC		MVV	
	Mean diff.	Sig.	Mean diff.	Sig.
Group 1 Vs 2	1.3	S	9.8	S
Group 1 Vs 3	0.8	NS	19.8	S
Group 1 Vs 4	1.8	S	29.6	S
Group 1 Vs 5	1.6	S	61.0	S
Group 2 Vs 3	-0.51	NS	10.0	S
Group 2 Vs 4	0.45	NS	19.8	S
Group 2 Vs 5	0.24	NS	51.2	S
Group 3 Vs 4	0.97	NS	9.8	S
Group 3 Vs 5	0.76	NS	41.2	S
Group 4 Vs 5	-0.20	NS	31.4	S

Multiple comparisons for the above variables between different age groups can be interpreted from the Post Hoc analysis which shows that, mean differences in SVC between group 1 and 2, group 1 and 4 & group 1 and 5 are significant whereas MVV is significant amongst all the age groups.

Table 6: Correlation of age with lung functions for the subjects of age group from 25-75 years

	r value	P value
AGE Vs FVC	-0.446	P < 0.05
AGE Vs FEV_1	-0.495	P < 0.05
AGE Vs PEFR	-0.427	P < 0.05
AGE Vs FEV_1/FVC	-0.312	P < 0.05
AGE Vs SVC	-0.392	P < 0.05
AGE Vs MVV	-0.919	P < 0.05

Table 6 displays the Karl Pearson correlation values between the age and lung functions within different age-groups. The values of correlation (r) of age with FVC, FEV_1, PEFR, FEV_1/FVC, SVC and MVV are given in the table. The values of all lung functions are negatively correlated with age which shows that lung functions significantly decline with age.

Discussion

Aging of population is a significant product of demographic transition. It is associated with progressive constriction of the homeostatic reserve resulting in homostenosis of every organ. To the best of our knowledge not many studies have been conducted to gather the information regarding pulmonary function tests in different age groups in northern India. Therefore, the major purpose of the present study was to establish the influence of age on pulmonary function tests from a randomized sample of urban population.

In the present study it was found that:

- FVC showed a decline of 28.61 % with the advancement of age.
- FEV1 showed a decline of 28.54 % with the advancement of age.
- PEFR showed a decline of 24.86 % with the advancement of age.
- SVC showed a decline of 30.48 % with the advancement of age.
- MVV showed a decline of 37.04 % with the advancement of age.

The present study has shown the values that are almost comparable & similar to the study conducted amongst elderly Chinese *(Woo & Pang, 1988)*, with only difference that women and not

men showed an age related decline in FVC in Chinese. Similar decline with age was obtained in studies conducted on the elderly European males and females; however the values of FVC obtained in both sexes were higher than the present study *(Rio et al, 2004)*. *Wu & Yang (1990)* conducted a study on Maximal expiratory flow and volume in Chinese aged 60 years and over. Spirometry and maximal expiratory flow-volume curves in 180 healthy (102 women, 78 men) aged 60 years and over in Taiwan were obtained. FEV_1/FVC and $V_{max}25\%$ were negatively correlated with age in the men.

The present findings could be explained on the basis of two major changes to the pulmonary system associated with aging. These changes are decreased elastic recoil and stiffening of the chest wall *(Zaugg & Lucchinetti, 2000)*. Elastic recoil on the lungs depends on the composition of the connective tissue, and alveolar surface tension produced by surfactant *(Dempsey & Seals, 1995)*. Very limited evidence suggests that the structure of the connective tissue may be the primary mechanism for age-associated change in elastic recoil. Chest wall stiffness is rather accompanied by an increase in chest anterio-posterior diameter, costal cartilage calcification, narrowing of the intervertebral disks, and change in rib to vertebrae articulations *(Zaugg & Lucchinetti, 2000)*.

In addition to this, decreases occur with alveolar-capillary surface area, the alveolar septal surface area, and the total surface area of the lung parenchyma *(Brody & Thurlbeck, 1985)*. This reduces the alveolar surface area available for gas exchange and increase the amount of physiological dead space *(Zaugg & Lucchinetti, 2000)*.

Changes in the surface area result in a decrease in the diffusion capacity of the lung. Both the loss of surface area and a decrease in pulmonary capillary blood volume contribute to reduced and uneven ventilation to perfusion matching in elders. The resting partial arterial pressure of oxygen declines 5-10 mm Hg between the ages 25 & 75 years *(Dempsey & Seals, 1995)*.

Pulmonary functions remain the major biologic variable that is affected by aging. Extent of the ageing process in the lungs shows great inter-individual variations *(Thurlbeck & Wright, 1999)*. Even in individuals who enjoy apparently good health, there are measurable decrements in function of the respiratory system with age *(Campbell, 2008)*. If it is understood that how such ageing changes could be minimized, it might be possible to improve quality of the "added years" into old age *(Pride, 2005)*. The constantly increasing life expectancy of the general population requires the physicians and physiotherapists to consider more closely the effect of aging on the so called 'normal function' of different organs. Clinically this study has shown that how older people can have meaningful measurements made of FEV_1 and FVC, if there is careful attention to technique and data quality. These tests, when combined with an informed evaluation of respiratory symptoms, should lead to the timely and accurate diagnosis of respiratory disorders, which in turn may result in better management by incorporating a good knowledge about the disease and exercise programs for them.

References

Brody, J. S. and Thurlbeck, W. M. 1985. Development, growth and aging of the lung. In Fishman, A.P. (Ed). Handbook of Physiology, **3(2):** 685-93.

Campbell, E. J. 2008. Aging of the respiratory system. In: Fishman AP (Ed). Fishman's Pulmonary Diseases and Disorders. 4th ed. China: Mcgraw Hill Companies, Inc., 263-76

Culver, B. H. and Butler, J. 1985. Alterations in pulmonary function. In: Principles of Geriatric Medicine Ed. Andes, R., Bierman, E.L. and Hazzard, W.R. McGraw Hill Book Co. Ltd. (London); Chapter 26, 280-287

Dempsey, J. A. and Seals, D. R. 1995. Aging, exercise and cardiopulmonary function. *In Holloszy, J.* (Ed.) Perspectives in exercise science. New York: Williams & Wilkins, **4(1):** 685-693

Etter, J. F., Houezec, J. L. and Perneger, T. V. 2003. A Self administered questionnaire to measure dependence on cigarettes. The cigarette dependence scale. *Neuropsychopharmacology*. **28:** 359-370.

Friedberg, F. and Jason, L. A. 2002. Selecting a fatigue rating scale. *The CFS Research Review*, **35:** 7-11

Janssens, J. P. 2005. Aging of the respiratory system: Impact on pulmonary function tests and adaptation to exertion. *Clin. Chest. Med.*, **26(3):** 469-84

Knudson, R. J., Lebowitz, M. D., Holberg, C. J., Burrows B. 1983. Changes in the normal maximal expiratory flow-volume curve with growth and aging. *Am. Rev. Respir. Dis.*, **127:** 725-34.

Pride N B. Ageing & Changes in Lung mechanics. *Eur Respire J* 2005; 26:563-5.

Pryor, J. and Prasad, S. 2005. Physiotherapy for respiratory and cardiac problems. Adults and Paediatrics; 3rd Ed: 6

Rio, F. G., Pino, J. M., Dorgham, A. and Villamor, A. J. 2004. Spirometric reference equations for European females and males aged 65-85 years. *Eur. Respire. J.*, **24:** 397-405.

Thurlbeck, W. M. and Wright, J. L. 1999. The Aging Lung**.** In: Thurlbeck's chronic airflow obstruction. Canada: Hamilton, **2(1):** 128-31.

Verma, S. S., Sharma, Y. K. and Arora, S. 2002. A multivariate study of some lung function tests at different age groups in healthy Indian males. *Ind. J. Chest Dis. Allied Sci.*, **44:** 85-9

Woo, J. & Pang, J. 1988. Spirometry in healthy elderly Chinese. *Thorax*, **43:** 617-20

Wu, H. D. and Yang, S. C. 1990. Maximal Expiratory Flow and Volume in Chinese aged 60 years and over. *J. Formos Med. Assoc.*, **89(9):** 749-55

Zaugg, M. & Lucchinetti, E. 2000. Respiratory function in the elderly. *Anesthesiology Clin. North America*, **18:** 47-58.

A Study of Lipid Profile in Type 2 Diabetic Punjabi Population

Singh[1], G. and Kumar[2], A.K.

[1]**Research Scholar,** Department of Sports Science, Punjabi University Patiala (India) Email: drgurdeep_sahni@yahoo.co.in
[2]**Assistant Professor,** Department of Sports Science, Punjabi University Patiala (India) Email: akashokin@gmail.com

Abstract

Aims: The purpose of the study was to observe the lipid profile of type 2 diabetics in the male Punjabi population. *Method(s)*: A total of 120 Type 2 diabetic men with an age range from 30 to 70 years volunteered to participate in this study. The fasting blood sugar (FBS) & lipid profiles were recorded with standard procedure. *Results*: The mean age and FBS were 50.3 ± 11.8 years and 135.1±27.4 mg/dl respectively. There were 59% subjects with high total cholesterol (TC) levels and 98% were having increased LDL levels. 89% of the subjects were found with lower HDL level. *Conclusion*: It is concluded from the results of the present study that in type 2 diabetics dyslipidaemia was very common especially raised LDL levels. Results strongly suggest that further investigations should relate the effects of dyslipidaemia and abnormalities of insulin resistance in type 2 diabetics. And ethnic specific patterns of lipid profile in type 2 diabetics regardless of their glucose levels, suggests that ethnic-specific strategies and guidelines on risk assessment and prevention of CVD due to dyslipidemia are required.

Keywords: CVD, FBS, Dyslipidaemia.

Introduction

Dyslipidemia is one of the major cardiovascular disease (CVD) risk factors and plays an important role in the progress of atherosclerosis, the underlying pathology of CVD. The prevalence of dyslipidemia in type 2 diabetes is double with respect to the general population *(Haffner, 1998)*. These are more complex abnormalities that are caused by the interrelation among obesity, insulin resistance and hyperinsulinism *(Burstein et al., 1970 & American Diabetes Association, 1998)*. According to *Freedman et al (1999)*, when the overweight subjects were compared with their respective thinner counterparts, they presented 2.4 to 7.1 times higher probability to have an elevated total cholesterol, LDL cholesterol, triglycerides and blood pressure as well as 12.6 times higher probability to have hyperinsulinemia. It is worth to emphasize that the fatty tissue is exclusively related to risk factors, such as the altered insulin and lipid profile, which can contribute to the development of the insulin resistance syndrome, which comprises several risk factors for the emergence of cardiovascular complications *(Gower, 1999)*. In patients with type 2 diabetes, which is equivalent to CHD *(Juutilainen et al, 2005)*, it is most commonly characterized by elevated TG and reduced HDL-C *(Goldberg 2001)*. These abnormalities can be present alone or in combination with other metabolic disorders. The prevalence of dyslipidaemia varies depending on the

population studied, geographic location, socioeconomic development and the definition used *(Wood et al, 1972; Berrios et al, 1997).* Very few cross-sectional studies have evaluated the relationship between lipid and blood glucose concentrations in type 2 diabetics in Punjabi population. The present study was planned to identify the prevalence of abnormalities in lipid profile among type 2 diabetic Punjabi population.

Materials and Methods

One hundred and twenty type 2 diabetic male patients belonging to Patiala district of Punjab were selected as subjects after obtaining their informed written consent and their age ranged from 30-70 years. The objectives of the present study were thoroughly explained to them. Clinical history was also documented and following exclusion criteria were used- not taken any steroid therapy in past 3 months, any liver, kidney or cardiac failure, neoplasm and patients who were on any type of anti-lipidemic therapy. The study protocol was reviewed and approved by the Ethics Committee of Punjabi University, Patiala. The serum was separated immediately after obtaining the blood sample (overnight fasting) by using centrifugation for 10 minutes. Fasting blood glucose concentration and Lipid Profile [Total Cholesterol (TC), HDL, VLDL & Triglycerides (TG)] were measured using Blood Analyzer. The appropriate chemical testing kits were used. LDL was calculated by using Friedewald formula: LDL= TC – (TG/5) - HDL. For the descriptive and inferential statistics SPSS version 16 was used.

Results & Discussion

Table 1 shows the mean values of age and fasting blood sugar were observed to be 50.3± 11.8 years and 135.1±27.4 mg/dl respectively. Results of the BMI in the present study indicate that our subjects were not obese but their mean fasting blood sugar level was more than the normal value.

Table 1. Mean±SD of Age & FBS of Type 2 diabetics

Variables	Mean ± SD
Age (years)	**50.3 ± 11.8**
FBS(mg/dl)	**135.1 ± 27.4**

Table 2 shows the quantitative analysis of lipid profile of Type 2 diabetics and found that the mean total cholesterol (203.9 ±15.8 mg/dl), triglycerides (151.1 ± 17.7 mg/dl), HDL (47.7 ± 6.2 mg/dl), LDL (124.4 ± 11.9 mg/dl), VLDL (32.3 ± 7.1 mg/dl) & LDL / HDL ratio (2.63 ± .37).

Table 2. Mean±SD of lipid profile of Type 2 diabetics

Variables	
Total Cholesterol,TC (mg/dl)	**203.9±15.8**
Triglycerides, TAG (mg/dl)	**151.1± 17.7**
HDL-C (mg/dl)	**47.7±6.2**
LDL-C (mg/dl)	**124.4± 11.9**
VLDL (mg/dl)	**32.3 ± 7.1**
Ratio of LDL / HDL	**2.63±0.37**

TC- total cholesterol, HDL- high density lipoproteins, LDL-low density lipoproteins, VLDL- very low density lipoproteins, TG- triglycerides

The present study also analyzed the prevalence rate of hyper-cholesterolemia, hypertriglyceridemia, low HDL and high low density lipoproteinaemia among type 2 diabetics. It was found that 59% Type 2 diabetics in this study had hypercholesterolemia, 53% Hypertriglyceridemia and 98% abnormal LDL levels. In 89% of Type 2 diabetics, the HDL was less than 40 mg/dl. Thus, the results of the present study shows that in Type 2 diabetics the dyslipidaemia is the most common abnormality and it was found in the level of LDL-C value.

Discussion

For the interpretation of serum lipid reference values, the guidelines of National Cholesterol Education Programme (NCEP) Adult Treatment Panel III (ATP III) were followed. According to NCEP-ATPIII guidelines, hypercholesterolemia is defined as TC > 200 mg/dl, high LDL-C when value > 100 mg/dl, hypertriglyceridemia as TAG > 150 mg/dl and low HDL-C when value is < 40 mg/dl. Dyslipidemia was defined by presence of one or more than one abnormal serum lipid concentration *(Menik et al., 2005).*

The results of the present study were in agreement with the previous research reports that dyslipidemia, overweight and obesity is a common association with type 2 diabetic patients *(Haffner, 1998 and American Diabetes Association, 1998).* In the present study 59% of the subjects had hypercholesterolemia and 98% abnormal LDL levels. Type of dyslipidaemia reported among diabetic population is numerous in different places in world indicating that dyslipidemia can be influenced by the interaction of genetic and environmental factors *(Carlos et al, 2001).* The prevalence of the lipid abnormalities reported by Mexican nationwide survey done by *Carlos et al, (2001)* is similar to that observed in Turkish *(Mahley et al, 1995)* and other Asian populations, including Bangladeshi and Pakistani populations *(Bhopal et al, 1999).* Their study shows that 53% of the diabetic population had Hypertriglyceridemia. The present study is in agreement with the above report in relation to prevalence rates of hypertriglyceridemia among type 2 diabetic Punjabi population (53% in the present investigation and 54% in Mexican nationwide survey). It was also found that 98% of Type 2 diabetics had high LDL levels and 59% showed hypercholesterolemia. This observation further confirms that patients with Type 2 diabetes had co-incidence of several abnormal lipid profiles. It further confirms that dyslipidemia could have impact on the development of insulin resistance in type 2 diabetes mellitus. *Menik et al (2005*) reported a significant genetic association between development of insulin resistance and dyslipidemia among type 2 diabetic patients.

Conclusion

It is concluded from the results of the present study that type 2 diabetics were either overweight or type I obese and dyslipidaemia was very common. Results strongly suggest that further investigations should relate the effects of dyslipidaemia and abnormalities of insulin resistance in type 2 diabetics. And ethnic specific patterns of lipid profile in type 2 diabetics regardless of their glucose levels, suggesting that ethnic-specific strategies and guidelines on risk assessment and prevention of CVD due to dyslipidemia are required.

References

American Diabetes Association – Position Statement. Management of Dyslipidemia in Adults with Diabetes. Diabetes Care 1998, **21:** 179-82.

American Diabetes Association – Position Statement. Management of Dyslipidemia in Adults with Diabetes. Diabetes Care 2001, **24:** Supp 1.

Bhopal, R., Unwin, N., White, M., Yallop, J., Walker, L., Alberti, K.G., Harland, J., Patel, S., Ahmad, N., Turner, C., Watson, B., Kaur, D., Kulkarni, A., Laker, M., Tavridou, A. 1999. Heterogeneity of coronary heart

disease risk factors in Indian, Pakistani, Bangladeshi and European origin populations: cross sectional study. *Brit. Med. J.*, **319:** 215-20.

Burestin, M, Selvenick, H.R., Morfin, R. 1970. Rapid method for the isolation of lipoproteins from human serum by precipitation with polyanions. *Lipid Res.*, **11:** 583-583

Friedewald, W.T., Levy, R., Fredrickson, D.S. 1972. Estimation of the concentration of low-density lipoprotein cholesterol in plasma without use of the preparative ultracentrifuge. *Clin. Chem.*, **18:** 499–502.

Berrios, X., Koponen, T., Huiguang, T., Khaltaev, N., Puska, P., Nissinen, A. 1997. Distributionand prevalence of major risk factors of noncommunicable diseases in selected countries: the WHO Inter-Health Programme. *Bull. World Health Organ.* **75:** 99-108.

Carlos, A., Aguilar, S., Gustavo, O., et al. 2001. High prevalence of low HDL cholesterol concentrations and mixed hyperlipidemia in a Mexican nationwide survey. *J. Lipid Res.*, **42:** 1298-307.

Freedman, D.S., Dietz, W.H., Srinivasan, S.R., Berenson, G.S. 1999. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. *Pediatrics*, **103:** 1175-82.

Gower, B.A. 1999. Syndrome X in children: influence of ethnicity and visceral fat. *Am. J Hum. Biol.*, 11: 249-57.

Goldberg, I.J. 2001. Clinical review 124: Diabetic dyslipidemia: causes and consequences. *J. Clin. End. Metab.*, **86:** 965-971.

Haffner, S.M. 1998. Management of dyslipidemia in adults with diabetes. *Diabetes Care*, **21:** 160-78.

Juutilainen, A., Lehto, S., Ronnemaa, T., Pyorala, K., Laakso, M. 2005. Type 2 diabetes as a "coronary heart disease equivalent": an 18-year prospective population-based study in Finnish subjects. *Diabetes Care* **28:** 2901-2907.

Mahley, R.W., Erhan-Palaoglu, K., Atak, Z., et al. 1995. Turkish heart study: lipids, lipoproteins and apolipoproteins. *J. Lipid Res.*, **36:** 839-59.

Menik, H.L., Sammanthi, J.S., Priyantha, W.T., et al. Significant genetic association between insulin resistance and total cholesterol in type 2 diabetes mellitus; Preliminary study.

NCEP: *2001*. Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III). *JAMA*,**285:** *2486-97.*

Wood, P.D., Stern, M.P., Silvers, A., Reaven, G.M., von der Groeben, J. 1972. Prevalence of plasma lipoprotein abnormalities in a free-living population of the Central Valley, California. *Circulation*, **45:** 114-126.

Review Study on Effect of Stimulation of Vestibular Apparatus on Postural Muscle Tone in Cerebral Palsy

Mittal[1], R. & Narkeesh[2], A.

[1]Post graduate student, Department of Physiotherapy, Punjabi University, Patiala.
[2]Associate Professor, Department of Physiotherapy, Punjabi University, Patiala.

Abstract

Vestibular Apparatus is a part of inner ear or labyrinth which is responsible for maintaining posture and equilibrium of the body. Vestibular nuclei control selectively the excitatory signals to the antigravity muscles to maintain equilibrium by functioning in association with the pontine reticular nuclei via lateral and medial vestibulospinal tracts. Cerebral palsy is an umbrella-like term used to describe a group of chronic disorders impairing control of movement. A child with cerebral palsy may have difficulty with fine motor tasks, such as writing or cutting with scissors, experience trouble with maintaining balance and walking, or may develop involuntary movements. Aim of the study is to find the effects of induced vestibular stimulation on postural muscle tone in cerebral palsy. Searches of the review study register articles from google.com, pubmed.com, British medical journal.com, Medline, Pedro and online standardized journals. The study was conducted to find the effects of stimulation of vestibular apparatus on postural muscle tone in cerebral palsy. It was concluded that vestibular apparatus plays an important role in maintaining postural tone and vestibular lesions results in disequilibrium with loss of postural control. This review study explains the effect of vestibular apparatus stimulation on postural muscle tone. Vestibular system plays an important role in the achievement of normal motor development and coordination.

Key words: Vestibular apparatus, Postural tone, Vestibular nuclei, Postural reflexes, Vestibular apparatus stimulation, Cerebral Palsy

Introduction

Vestibular apparatus is a part of inner ear or labyrinth which is responsible for maintaining posture and equilibrium of the body. Maintenance of an upright posture involves postural reflexes (which include stretch reflex) which are aided by afferent sensory information from vestibular apparatus and efferent response is to the skeletal muscles. Vestibular apparatus is composed of bony and membranous labyrinth. Membranous labyrinth is a functional part of nervous system which consists of semicircular canals and otolith organs, utricle and saccule that are primarily responsible for equilibrium mechanism *(Guyton & Hall 2006)*. On standing upright, activity increases in the antigravity postural muscles to counteract the force of gravity this is referred to as Postural Tone *(Shumway et al, 2007)*.

Vestibular inputs activated by a change in head orientation alter the distribution of postural tone in the neck and limbs and have been referred to as Vestibullocollic and vestibular spinal reflexes. Antigravity muscles are the muscles in the body that are tonically active during quiet stance and include

Soleus and Gastrocnemius, Tibialis Anterior, Gluteus Medius, Tensor Fascia Lata, Iliopsoas, Thoracic Erector Spinae in the trunk along with intermittent activation of abdominals *(Basmajian, 1985)*. The muscle tone in these antigravity muscles is controlled by pontine reticular nuclei that excites the antigravity muscles through the pontine reticulospinal tract and medullary reticular nuclei transmits inhibitory signals to the antigravity anterior motor neuron by way of medullary reticulospinal tract. Vestibular nuclei control selectively the excitatory signals to the antigravity muscles to maintain equilibrium by functioning in association with the pontine reticular nuclei via lateral and medial vestibulospinal tracts. *(Guyton & Hall 2006)*.

Cerebral palsy is an umbrella-like term used to describe a group of chronic disorders impairing control of movement. The term cerebral refers to the brain's two halves, or hemispheres, and palsy describes any disorder that impairs control of body movement *(Madrona, 2001)*. An individual with cerebral palsy may have difficulty with fine motor tasks, such as writing or cutting with scissors; experience trouble with maintaining balance and walking; or be affected by involuntary movements, such as uncontrollable writhing motion of the hands or drooling. Some children with cerebral palsy are also affected by other medical disorders, including seizures or mental impairment. These children may have difficulty grasping objects, crawling, and walking. They may not get better as they grow up. This condition, that was called Little's disease for many years, is now known as spastic diplegia. It is one of the several disorders that affect control of movement and are grouped together under the term cerebral palsy. Cerebral palsy (ICP) is one of the most common diseases of the nervous system in children. The incidence ranges from 2.5 to 5.9 cases per 1,000 newborns *(Madrona, 2001)*. Cerebral palsy is classified into four broad categories -- spastic, athetoid, ataxic, and mixed forms -- in accordance with the type of movement disturbance.

Spastic cerebral palsy is the most common and affects 70 to 80 percent of patients. The muscles are stiff and permanently contracted. When both legs are affected by spasticity, they may turn in and cross at the knees. This causes a characteristic walking rhythm, known as the scissors gait. Individuals with spastic hemiparesis may also experience hemiparetic tremors, in which uncontrollable shaking affects the limbs on one side of the body. If these tremors are severe, they can seriously impair movement. Athetoid, or dyskinetic, cerebral palsy is characterized by uncontrolled, slow, writhing movements which affect the hands, feet, arms, or legs and, in some cases, the muscles of the face and tongue, causing grimacing or drooling. The movements often increase during periods of emotional stress and disappear during sleep. Patients may also have problems coordinating the muscle movements needed for speech, a condition known as dysarthria. Athetoid cerebral palsy affects about 10 to 20 percent of patients. Ataxic cerebral palsy is a rare form, affecting the sense of balance and depth perception. Affected persons often have poor coordination; walk unsteadily with a wide-based gait, placing their feet unusually far apart and experience difficulty when attempting quick or precise movements, such as writing or buttoning a shirt. These patients may develop intention tremors.

The ataxic form affects an estimated 5 to 10 percent of cerebral palsy patients. Mixed forms: It is common for patients to have symptoms of more than one of the previous three forms. The most common mixed form may include spasticity and athetoid movements.

The study was aimed to review the studies on the effects of stimulation of vestibular apparatus on postural muscle tone in cerebral palsy.

Methods

Searches of the review study register articles from google.com, pubmed.com, British medical journal.com, Medline, Pedro and online standardized journals and are presented below.

REVIEWS OF VARIOUS ARTICLES:

- *Studies supporting the role of vestibular apparatus stimulation on postural muscle tone***:**

Morningstar et al (2005) studied reflex control of spine and posture: a review of literature from chiropractic perspective. In this review there is an attempt to identify the important role the nervous system plays in maintaining reflex control of spine and posture. It concluded that visual and vestibular input as well as joint and soft tissue mechanoreceptors play an important role in the regulation of static upright posture. In this study manual search was done for available relevant textbooks, and a computer search of the medline, mantis, and Index to Chiropractic Literature. Studies were selected if they specifically tested any or all of the postural reflexes either in Earth's gravity or in microgravitational environments. Studies testing the function of each postural component, as well as those discussing postural reflex interactions, were also included in this review. This review of the postural reflex structures and mechanisms adds to the growing body of posture rehabilitation literature. Chiropractic interest in these reflexes may enhance the ability of chiropractic physicians to treat and correct global spine and posture disorders.

Ardic et al (2000) in their study used Galvanic (electrical) vestibular stimulation (GVS) to study the role of the vestibular system in postural control by inducing postural sway in standing subjects. They found that both the paraspinal and gastrocnemius muscles became activated in response to the stimulus. The results of this study suggest that the paraspinal muscles may play a significant role in the frontal plane response to vestibular stimulation during stance in humans. In this study Bineural-bipolar GVS was applied to the skin overlying the mastoid processes of 10 subjects while they stood on a force plate with their eyes closed. The stimulus consisted of a 0.6 mA, 5-pulse sequence. Each pulse lasted for 2s, followed by 4s of rest. The centre of pressure (COP) vs. time for each trial was calculated from the reaction forces and moments. Surface electromyographic (EMG) signals from the paraspinal and gastrocnemius muscles were recorded bilaterally.

Crowne & Horak (1988) investigated the relationship of vestibular function to motor proficiency, including balance and concluded that impairments of motor proficiency in children with hearing impairments depend on vestibular function. Interventions for motor deficits

in children with hearing impairments, therefore, must consider vestibular function as well as motor performance. In their study thirteen children with normal hearing and 29 children with hearing impairments, ranging in age from 7 to 13 years, were classified into categories based on vestibular function using neuro-otologic measures (i.e., vestibulo-ocular reflex function and posturography). Children in each category were tested for motor proficiency using clinical assessment measures (eg, balance, muscle tone, and coordination). The test results indicated that the children with hearing impairments and normal peripheral vestibular function (n=7) exhibited normal motor proficiency, including balance. The children with hearing impairments and loss of peripheral vestibular sensitivity (n=19) also demonstrated normal motor proficiency, except for balance ability**.**

Watson (1997) showed EMG responses in the soleus muscle evoked by unipolar galvanic stimulation. They concluded that vestibular activation by clicks can evoke reflex responses in lower-limb muscles and these responses have similar characteristics to the responses evoked by galvanic vestibular stimulation. *Reschke et al (1986)* showed Vesibulospinal response modification as determined with the H-reflex during the space lab-1 flight. In this study the H reflex was recorded from the soleus muscle as a method of monosynaptic reflex testing in conjunction with vertical linear acceleration to assess modification of utrculo-saccular function induced through prolonged exposure to microgravity. It showed that early post flight did show an increase in EMG activity and the early inflight H- reflex amplitude was similar to that recorded at preflight.

Table 1: Summary of Studies supporting the role of vestibular apparatus stimulation on postural muscle tone

Author	**Conclusion**
Morningstar (2005)	Studied reflex control of spine and posture: a review of literature from chiropractic perspective. It concluded that visual and vestibular input as well as joint and soft tissue mechanoreceptors play an important role in regulation of static upright posture.
Ardic et al (2000)	The results of this study suggest that the paraspinal muscles may play a significant role in the frontal plane response to vestibular stimulation (galvanic (electrical) vestibular stimulation) during stance in humans
Crowne & Horak (1988)	Investigated the relationship of vestibular function to motor proficiency, including balance and concluded that impairments motor proficiency in children with hearing impairments depends on vestibular function.
Watson (1997)	Concluded that vestibular activation by clicks can evoke reflex responses in lower-limb muscles and these responses have similar characteristics to the responses evoked by galvanic vestibular stimulation
Reschke et al (1986)	Showed vesibulospinal response modification as determined with the H-reflex during the space lab-1 flight.

❖ *Studies supporting effect of stimulation of vestibular apparatus on postural muscle tone in cerebral palsy*

Unayik & Kahiyan (2011) in his article "Down Syndrome: Sensory Integration, Vestibular Stimulation and Neurodevelopmental Therapy Approaches for Children" described that the role of vestibular system is important in the achievement of normal motor development and coordination *(Shumway & and Cook, 1992).* The vestibular dysfunction is observed in many developmental disorders as motor discoordination and learning disabilities

(Horak et al, 1988). The vestibular system is one of the first sensory systems that develop prenatally and is functional at birth due to the completion of its structure anatomically *(Shumway & and Cook, 1992)*. The vestibular system is particularly important in the development of motor skills, the integration of postural reflexes, forming coordinated eye movements, and visual attention skills, and also in developing inquiring-behavior, and regulating the level of liveliness *(Ottenbacher et al, 1983)*. In contrast to children with isolated vestibular pathology, serious problems are observed in the motor sufficiency of children who demonstrate insufficiency in efficiently organizing visual somatosensorial inputs and normal vestibular inputs for postural control. Therapists who treat children with vestibular dysfunction stimulate the vestibular system with equipment such as swings, scooter boards, and hammocks *(Shumway & and Cook, 1992)*. Ayres stated that, according to the sensory integration theory, the effect of vestibular stimulation in the central nervous system stems from the plasticity of the nervous system, and that the improvement observed in children in the period following the intervention is continuous because of undeveloped brain plasticity *(Ayres, 1979)*. Ayres pointed out that different head positions and movements are necessary for the stimulation of vestibular receptors, but particularly the horizontal position is more important *(Ayres, 1979)*. Types of vestibular stimulations are to normalization of extensor muscle tone by increasing otolith organ input, linear activities are given in accordance with the order of motor development. These are: bouncing-jumping activities (whilst sitting, kneeling, or standing), linear swinging activities (using platform and T-swing, glider, hammock and barrel swinging in kneeling, standing, sitting, creeping and, prone and supine positions) and other linear activities (jumping or falling onto pillows or mattress in sitting, prone and supine positions). To development of equilibrium reactions by increasing semicircular canal responses, the center of gravity is changed to create disorganization for a short time and thus phasic head movements are made to appear. For this, by moving the support surface, the center of gravity is changed as active or passive and by pushing-pulling activities; displacement of the center of gravity is created. These are activities which enable active equilibrium on steep surfaces such as stairs, ramps and unfamiliar surfaces by using equipments such as balance boards, therapy balls and barrel. To lessen the fear of movement or positional change by increasing the weak passing of otolith input, linear vestibular stimulation is applied in tolerable speeds and durations and in unthreatening positions *(Fisher, 1989)*.

Table 2: Summary of Studies supporting effect of stimulation of vestibular apparatus on postural muscle tone in cerebral palsy

Author	Conclusion
Unayik & Kahiyan (2011)	Reported that vestibular system is important in the achievement of normal motor development and treatment approach to cerebral palsy child should consist of physiotherapy programs toward the development of postural reactions, proprioceptive and vestibular stimulation for the development of visual-motor coordination and normalization of muscle tone.
Brown (2007)	Reported that in children

	with cerebral palsy there is abnormal muscle tone, limited movement abilities and problems with tactile and proprioceptive perception due to dysfunction in vestibular sense
Madrona (2001)	This study indicated that using the"adeli" method in the rehabilitation of children diagnosed with cerebral palsy stimulates the restarting of the developmental process of the vestibular system and helps in normalization of muscle tone.
Robert et al (1990)	Stated that vestibular system plays an important role in balance and equilibrium and it reinforces the tone of extensor muscles of limbs and trunk thus is responsible for normal gait.

Discussion

Vestibular apparatus has an important role in postural muscle tone. *Morningstar (2005)* studied reflex control of spine and posture: a review of literature from chiropractic perspective. In this review there is an attempt to identify the important role the nervous system plays in maintaining reflex control of spine and posture. It concluded that visual and vestibular inputs as well as joint and soft tissue mechanoreceptors play an important role in the regulation of static upright posture. Study of various articles showed that stimulation of vestibular apparatus cause activation of postural tone. Disorders of vestibular apparatus cause difficulty in maintaining balance. The present review study shows that there is further need to find relation between vestibular apparatus and postural muscle tone and further to describe the role of vestibular stimulation in postural tone and its quantification through excitation of monosynaptic reflex in normal adolescents.

The studies of various articles emphasize the role of vestibular system in maintaining normal motor development and co-ordination. In case of cerebral palsy there is abnormal muscle tone, limited movement abilities and problems with tactile and proprioceptive perception. The effectiveness of facilitation of sensory integeration through the vestibular stimulation is a major component of sensory integerative treatment. The vestibular system is particularly important in the development of motor skills, the integration of postural reflexes, forming coordinated eye movements, and visual attention skills, and also in developing inquiring-behavior, and regulating the level of liveliness *(Ottenbacher, 1983).*

In contrast to children with isolated vestibular pathology, serious problems are observed in the motor sufficiency of children who demonstrate insufficiency in efficiently organizing visual somatosensorial inputs and normal vestibular inputs for postural control. Therapists who treat children with vestibular dysfunction stimulate the vestibular system with equipment such as swings, scooter boards, and hammocks *(Shumway & and Cook, 1992).* Ayres stated that, according to the sensory integration theory, the effect of vestibular stimulation in the central nervous system stems from the plasticity of the nervous system, and that the improvement observed in children in the period following the intervention is continuous because of undeveloped brain plasticity *(Ayres, 1972).* Further research is required to use vestibular stimulation in habituating the neuromuscular loop resulting in a quantifiable difference in muscle tone. With this new techniques

that assist with motor control deficiency found in cerebral palsy can be invented.

Conclusion

The review study concluded that there is supporting literature about the relation between functioning of vestibular apparatus and postural muscle tone. This review shows that stimulation of vestibular apparatus causes increase in activation of postural muscle tone. Vestibular system plays an important role in the achievement of normal motor development and coordination. In contrast to children with isolated vestibular pathology, serious problems are observed in the motor sufficiency of children who demonstrate insufficiency in efficiently organizing visual somatosensorial inputs and normal vestibular inputs for postural control. Stimulation of vestibular receptors is used to normalization of extensor muscle tone by increasing otolith organ input; linear activities are given in accordance with the order of motor development.

There are a number of precautions to consider the vestibular stimulation such as as a result of over stimulation, sensory overload occurs and this results in organization dysfunctions in the central nervous system. Therefore, over stimulating should be avoided, and before, during, and after vestibular stimulation, the child should be checked for evidence of over stimulation or under stimulation and allowed to determine his own speed. The over inhibition of the brainstem is the greatest potential harm resulting in seizures, cyanosis, and depression in vital functions. In children with hypertonicity, a counter effect in the form of more tone increase may occur. Sensory stimulation response is different in each child, and the child should be checked carefully at this time *(Fisher, 1989).* This study concluded that family education within early intervention programs for infants should give importance to the prone position and the variety of movement, and should consist of physiotherapy programs toward the development of postural reactions, proprioceptive and vestibular stimulation, the perception of the sense of touch and body awareness, ocular control and the development of visual-motor coordination.

Rehabilitation of Children Diagnosed with Cerebral Palsy Using "Adeli" Suit is based on Dynamic Proprioceptive Correction *(Madrona, 2001).* Development of the brain and the spinal cord is significantly influenced by the interceptive impulses from the ligamento-muscular apparatus and vestibular system. Structures of the vestibular system are one of the major zones processing impulses from proprioceptors. Factors injuring/damaging the central nervous system (CNS) significantly compromise functions at all levels of the vestibular system. This results in (motor) dysfunction in all CNS levels responsible for the formation and control of movement. This study indicated that using the"Adeli" method in the rehabilitation of children diagnosed with Cerebral Palsy stimulates the restarting of the developmental process of the vestibular system and helps in normalization of muscle tone. Gradually, particularly after the 2nd and 3rd rehabilitation session, the function within the semicircular canals and otolithic organs normalized and manifested in decreased spasticity. Improvement in vestibular system functioning resulted in diminished

hyperkinesis. Application of "Adeli" Suit therapy influences the flow of the afferent prioprioceptive impulses which in turn stimulate the development of the vestibular system.

The vestibular system integrates all other functional systems, which stimulate the postnatal development of the CNS. The CNS determines the normalization of motor development, speech and cognitive development. Sensory Integrative Treatment was developed out of the extensive research of A. Jean Ayres, an occupational therapist with a strong interest in the sensory systems and sensory integrative dysfunction *(Ayres 1972)*. Therapy provides controlled sensory input (especially input from the vestibular, tactile, and proprioceptive systems) in a way that allows the child to make an adaptive response that integrates the sensations and enhances the organization of the brain.

References

Ardic, F.N., Latt, L.D., Redfern, M.S. 2000. Paraspinal muscle response to electrical vestibular stimulation. *Acta. Otolaryngol*. **120:** 39-46.

Ayres, A.J. 1979. Sensory integration and the child. Los Angeles: Western Psychological Services". taken from Unayik M. and Kahiyan H. 2011. Down syndrome: sensory integeration, vestibular stimulation and Neurodevelopmental therapy approaches for children. *Intern. Encyclop. of Rehab*.. In: J.H. Stone, M. Blouin, editors Link: http://cirrie.buffalo.edu/encyclopedia/en/article/en/article/48/

Basmajen, 1985. taken from Anne Shumway, Cook, Marjorie H. Woollacott (2007), "Motor control: Translating research into clinical practice". 3rd edition, Publisher: Philadelphia: Lippincott Williams ann Wilkins. pp 160-165

Brown, D. 2007. The vestibular sense" Link:http://filescadbs.org/2000000353_9f7fca079e/2_vestibular_dbrownpdf

Christropher J.D, Billy, L., Luu, K., van den, D., Inglis, J.T, Blouin, J.S 2009. Frequency-Specific modulation of vestibular evoked sway Responses in humans" *J. Neurophysiol.,* **103(2):** 1048-1056

Crowne T.K, Horak F.B 1988. Motor proficiency associated with vestibular deficits in children with hearing impairments" *Acta Otolaryngol* **68(10):** 1493-149.

Fisher, 1989. Taken from Unayik M. and Kahiyan H.(2011), " Down syndrome: sensory integeration, vestibular stimulation and Neurodevelopmental therapy approaches for children" *International Encyclopedia of Rehabilitation* In: J.H. Stone, MBlouin, editors Link:http://cirrie.buffalo.edu/encyclopedia/en/article/en/article/48/

Guyton, A.C, Hall, J.E. 2006. Textbook of Medical Physiology. 11th edition, Elsevier founder publication. 692-697

Horak, F.B., Shumway-Cook, A, Crowe, TK, Black, F.O. 1988. Vestibular function and motor proficiency of children with impaired hearing, or with learning disability and motor impairments". Developmental Medicine and Child Neurology: 64-79. taken from Unayik M. and Kahiyan H. 2011. Down syndrome: sensory integeration, vestibular stimulation and Neurodevelopmental therapy approaches for children" *International Encyclopedia of Rehabilitation.* In: J.H. Stone, M. Blouin, editors Link: http://cirrie.buffalo.edu/encyclopedia/en/article/en/article/48/

Levinson, H.N. 1990. The Diagnostic Value Of Cerebellar-Vestibular Tests In detecting Learning disabilities, dyslexia, attention deficit disorders, Perceptual and Motor skills" *J. Neuropsych.* 71: 67-82.

Lin, S.R, Gage, R.J 1990. Neurological control system for normal Gait" 2(1): 1-13.

Madrona 2001. http://www.healing-arts.org/children/cp/cpoverview.htm

Morningstar, M.W., Pettibon, B.R, Schlappi. H., Schlappi, M. and Ireland, T.V. 2005. Reflex control of spine and posture: A review of literature from a Chiropractic perspective and osteopathy. *J. Phys. Occup. Ther*., 16(2): 1-21.

Ottenbacher, K.J., Petersen, P. 1983. The Efficacy of Vestibular Stimulation as a Form of Specific sensory Enrichment. Quantitative Review of the Literature. Clinical Pediatrics, 428-433 taken from Unayik, M. and Kahiyan, H. 2011. Down syndrome: sensory integeration, vestibular stimulation and Neurodevelopmental therapy approaches for children" *International Encyclopedia of Rehabilitation* In: J.H. Stone, M. Blouin, editors. Link: http://cirrie.buffalo.edu/encyclopedia/en/article/en/article/48/

Reschke, M.F., Anderson, D.J., Homick, J.L 1986. Vestibulospinal Response Modification as determined with the H- Reflex during the space lab-1 flight. *J. Appl. Physiol*., **90(3):** 997-1006.

Shumway, Cook, A., Woollacott, M.H. 2007. Motor control: Translating research into clinical practice. 3rd edition, Publisher: Philadelphia: Lippincott Williams and Wilkins, 160-165

Shumway and Cook, A. 1992. Role of the Vestibular System in Motor Development: Theoretical and Clinical Issues. In: Forssberg, H., Hirschfeld, H. (Editors), Movement Disorders in Children. Medicine and Sport Science. Basel, Karger taken from Unayik M. and Kahiyan H. 2011. Down syndrome: sensory integeration, vestibular stimulation and Neurodevelopmental therapy approaches for children" *International Encyclopedia of Rehabilitation* In: J.H. Stone, M.Blouin, editors Link:http://cirrie.buffalo.edu/encyclopedia/en/article/en/article/48/

Unayik, M. and Kahiyan, H. 2011. Down syndrome: sensory integeration, vestibular stimulation and Neurodevelopmental therapy approaches for children" *International Encyclopedia of Rehabilitation* In: Stone, J.H. & Blouin, M, editors Link:http://cirrie.buffalo.edu/encyclopedia/en/article/en/article/48/

Watson, S.R.D. 1997. EMG responses in the soleus muscle evoked by unipolar galvanic Stimulation." *J. Electromyog. Mot. Cont.* **15(6):** 476-483.

Relationship among Anthropometric Indices & Motor Nerve Conduction Velocity of Radial & Ulnar Nerves in Aerobic Trained Athletes

Soodan[1], J.S. & Kumar[2], A.
[1]Ph.D. Research Scholar, Department of Sports Science, Punjabi University Patiala, Punjab (India). Email: jogbinder.jb@gmail.com,
[2]Assistant Professor, Department of Sports Science, Punjabi University Patiala 147002, Punjab (India) Email: akashokin@gmail.com

Abstract

The purpose of this study was to investigate the relationship among anthropometric indices (upper extremity lengths and circumferences) and motor nerve conduction velocity (MNCV) of radial & ulnar nerve (bilateral side) in aerobic trained athletes (long distance runners & cyclists). A total of 50 male long distance runners & cyclists with an average age, height and weight of 23±2 years, 172.8±5.8 cm and 70.05±4.2 Kg respectively, volunteered to participate in this study. Each subject's MNCV was measured with the help of computerized equipment called "NEUROPERFECT" (Medicaid Systems, India) and the data was analyzed using Mean ±SD and Pearson correlation. Results shows that MNCV of right radial and left radial was negatively and significantly related with right upper arm length ($r=0.-40$ $p < 0.01$) and left upper arm length ($r=0.-37$ $p < 0.05$). But a positive and significant relationship of MNCV of right ulnar and left ulnar was found between right upper arm circumference ($r=0.33$ $p < 0.05$) and left upper arm circumference ($r=0.36$ $p < 0.05$). Thus, it is concluded that the positive relationship of MNCV of radial and ulnar nerve in aerobic trained athletes may be the result of their long term training adaptations which may be further related to their pattern of movement requirement.

Key Words: **Long Distance Runners, Cyclists**

Introduction

Theorists have pointed to the contribution of neurological system to the performance of the athletes of different sports due to the requirement of different motor actions *(Payne & Morrow, 1993)*. The findings of nerve conduction velocity may give explanations for poor performance of the athletes due to poor muscle coordination and/or weakness of muscle actions *(Wilbourn, 1990)*. It is more meaningful and interesting to observe the relationship of anthropometric indices and motor nerve conduction velocity in upper extremities of aerobic trained athlete like long distance runners & cyclists, who need to control their movement patterns accurately and maintained pace or speed during the performance and this requires neural adaptation in them. In theory, changes in MNCV may be an indicator of improved neural adaptations in athletes due to their exercise training program. *Halar et al (1985)* pointed out that the influence of physical activity is not the same for all types of exercise and that not all nerves may be affected in the same way. *Campbell et al (1981)* reported that the motor nerve conduction velocity is also influenced by other variables like body segment lengths/breadths and circumferences/girths. Longer nerves

generally conduct more slowly than shorter nerves (*Campbell et al, 1981*). Thus, the purpose of this study was to investigate the relationship among anthropometric indices and motor nerve conduction velocity (MNCV) of radial & ulnar nerve (bilateral side) in aerobic trained athletes (long distance runners & cyclists) and to understand whether their neural specification would change from long term training.

Material and Methods

Fifty aerobic trained athletes (25 long distance runners & 25 cyclists) in the age range of 18-25 years were voluntarily recruited as subjects in the present study on the basis of their predominant energy system i.e. aerobic. An informed consent was obtained from all the subjects. Motor Nerve Conduction Velocity (MNCV) was assessed with the help of computerized equipment called "Neuroperfect" (Medicaid Systems, India) by using the standard technique *(Smorto & Basmajian, 1979).* The subject lay supine on a wooden table with the straight arm as radial and ulnar motor nerve conduction velocity was tested. The differences in the mean values and relationship among anthropometric indices and MNCV was identified using Pearson correlation with a significance level of $p < 0.05$ by statistical software 'SPSS' version 10.

Results & Discussion

The mean age, body height and body weight of the subjects were 23±2 years, 172.8±5.8 cm and 70.5±4.2 kg respectively. The means of right and left upper arm length & lower arm length were 13.7 cm, 13.4 cm, 11.1 cm and 10.9 cm respectively. The means of right and left hand length and hand breadth were 8.1 cm, 7.9 cm, 9.2 cm and 9.1 cm respectively. The means of right and left upper arm, fore arm and wrist circumferences were 10.2 cm, 9.9 cm, 9.5 cm, 8.9 cm, 7.0 cm and 6.7 cm respectively. The mean of motor nerve conduction velocity of right and left radial nerve and ulnar nerve were 42.4 m/s, 42.6 m/s, 41.7 m/s and 41.4 m/s respectively (Table 1).

Table 1: Mean ±SD of Anthropometric indices & MNCV of aerobic trained athletes

Variables	Mean±SD
Age (years)	23±2
Body Height (cm)	172.8±5.8
Body Weight (Kg)	70.5±4.2
Right Upperarm length (cm)	13.7±0.9
Left Upperarm length (cm)	13.4±0.8
Right Lower arm length (cm)	11.1±0.8
Left Lower arm length (cm)	10.9±0.9
Right Hand length (cm)	8.1±1.8
Left Hand length (cm)	7.9±1.9
Right Hand breadth (cm)	9.2±3.2
Left Hand breadth (cm)	9.1±3.0
Right Upper arm circumference (cm)	10.2±1.4
Left Upper arm circumference (cm)	9.9±1.2
Right Fore arm Circumference (cm)	9.5±1.1
Left Fore arm Circumference (cm)	8.9±1.3
Right Wrist circumference (cm)	7.0±0.7
Left Wrist circumference (cm)	6.7±1.1
MNCV of right radial (m/s)	42.4± 6.9
MNCV of left radial (m/s)	42.6± 7.3
MNCV of right ulnar (m/s)	41.7± 6.1
MNCV of left ulnar (m/s)	41.4± 6.5

The mean value of motor nerve conduction velocity (MNCV) of right and left radial and ulnar nerve was comparable. Further, the mean of motor nerve conduction velocity (MNCV) of

radial nerve (both right & left) was greater than ulnar nerve. Further, the differences in the bilateral mean values of anthropometric indices and motor nerve conduction velocity of radial and ulnar nerve were not statistical significant (Table 1).

The results of correlation showed that motor nerve conduction velocity (MNCV) of right radial and left radial was negatively and significantly related with right upper arm length (r=-0.40) and left upper arm length (r=-0.37) (Table 2).

Table 2: Correlations among segment lengths/breadths & MNCV of radial & ulnar nerve in aerobic trained athletes

Variables	MNCV of Right Radial	MNCV of Left Radial	MNCV of Right Ulnar	MNCV of Left Ulnar
Right Upperarm Length	-.40**	-0.26	-0.02	0.06
Left Upperarm Length	.29	-0.37*	0.03	0.08
Right Lowerarm Length	0.01	0.01	0.09	0.07
Left Lowerarm Length	0.03	0.02	0.05	0.09
Right Hand Length	0.01	-0.12	0.27	0.16
Left Hand Length	0.03	0.17	0.21	0.12
Right Hand Breadth	0.14	0.17	-0.04	0.06
Left Hand Breadth	0.11	0.15	0.06	0.09

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

The results of correlation showed that MNCV of right ulnar and left ulnar was positively and significantly related with right upper arm circumference (r=0.33) and left upper arm circumference (r=0.36) (Table 3).

Table 3. Correlations among circumferences/girth & MNCV of radial & ulnar nerve in aerobic trained athletes

Variables	MNCV of Right Radial	MNCV of Left Radial	MNCV of Right Ulnar	MNCV of Left Ulnar
Right Upper arm Circumference	-0.07	0.12	0.33*	0.23
Left Upperarm Circumference	0.09	0.17	0.27	0.36*
Right Forearm Circumference	-0.13	0.01	0.21	0.15
Left Forearm Circumference	0.15	0.03	0.17	0.03
Right Wrist Circumference	-0.01	0.14	-0.11	-0.12
Left Wrist Circumference	0.11	0.09	0.05	0.10

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

Discussion

In the presented study, the results showed that aerobic trained athletes had comparable motor nerve conduction velocity of radial and ulanr nerves but the difference between them were statistically nonsignificant. Further, the mean MNCV of radial nerve showed faster motor conduction velocity than the ulnar nerve. The results seem reasonable, since, the goals of long distance runners and cyclists training program are more rapid and coordinated movements in the upper and lower extremities. It may cause physiological adaptations in nerve structure. *Gerchman et al, (1975)* indicated that ventral motoneurons following long term exercise had histochemical changes. The changes in nerve conduction velocity may be indicative of adaptations in the nerve structure such as increased axon diameter and myelination *(Ross et al, 2001)*. It was also observed in the present study that motor nerve conduction velocity of radial and ulnar nerve was significantly and negatively related with upper arm length.

Similar results were also reported by *Falck and Stalberg (1995)*. The MNCV of right ulnar and left ulnar was positively and significantly related with right and left upper arm circumference. When a muscle becomes stronger in response to training, the gain in strength is usually attributed to an improvement in the size or quality of the muscle. Many upswings in strength are actually the result of alterations in the way the muscle is controlled by the nervous system. Specifically, the nervous system can do a better job of recruiting muscle fibres and collections of muscle cells (motor units) within the muscle during an athlete's sporting activity, thus producing more forceful movements *(Christensen & Galbo, 1983)*. In a competitive runner, the nervous system can also learn to activate motor units in a way which will produce not only the desired level of strength and power for a particular sport but also the most energy-efficient production of strength and power. It is presumed that the neural adaptation of muscles in the trained athletes is due to a more active recruitment of motor units and an increase of their firing rates upon maximum voluntary contraction. The recruitments of slow- (type I) and fast twitch (type IIa, b) muscle fibers are in relation to the intensity of effort. For rapid, powerful movements, the fast-twitch fibers are activated *(Edgerton, 1976)*. Further, it is also assumed that the improvement of strength performance may be due to the fact that the athletes can recruit more of type IIa, and especially type IIb, motor units during maximum contraction of the measured muscles, and that they can express their true strength capacity by increasing their capacity to recruit more type II motor units during rapid, powerful movements. This means that trained athletes can more fully activate their prime moving muscles in maximal voluntary contractions *(Sale, 1987)*. Thus, the nervous system plays a critically important role in the development of greater strength, and the nervous system can even learn patterns of muscle coordination and activation which can be utilized by the trained athletes to boost their performance in the sport competitions *(Al-Seffar, 1990)*.

Conclusion

It is concluded that the positive relationship of MNCV of radial and ulnar nerve in aerobic trained athletes may be the result of their long term training adaptations which may be further related to their pattern of movement requirement.

Acknowledgments: The authors would like to thank the long distance runners & cyclists who voluntarily participated in this study.

References

Al-Seffair, J. 1990. Never Mind the quality, What's the caost: An evaluation of EMG needle maintenace, *J. Electrophysiol, Tech.*, **16**: 179-191.

Campbell W.W, Ward L. and Swift T. 1981 Nerve conduction velocity varies inversely with height. *Muscle Nerve*, **3**: 436-437.

Christensen, N.J. and Galbo, H. 1983. Sympathetic activity during exercise. *Ann. Rev. Physiol.*, **44**: 139-153.

Edgerton, V.R. 1976. Neuromuscular adaptations power and endurance work. *Canadian J. Appl. Sports Sci.*, **1**: 49-58.

Falck B., and Stålberg E. 1995. Motor Nerve Conduction Studies: Measurement principles and interpretation of findings. *J. Clin. Neurophysiol.*, **12**: 254-279.

Gerchman, L.B., Edgerton, V.R, Carrow, RE. 1975. Effect of physical training on the histochemistry and morphology of

ventral motor neurons. *Exp Neurol*, **49:** 790-801.

Halar, E.M., Hammond, M.C. and Dirks, S. 1985. Physical activity: Its influence on nerve conduction velocity. *Arch. Phys. Med. Rehabil* ., **66**: 605-609.

Payne, I.G. and Morrow J. 1993. Exercise & VO2 max in children : A metaanalysis. *Med. Sci. Sports Exer*., **26:** 510-514.

Ross, A., Leveritl, M. & Riek, S. 2001. Neural influences on sprint running: training adaptations and acute responses. *Sports Med*., **31(6):** 409-25.

Sale, D.G. 1987. Influence of exercise training on motor unit activation. *Exer. Sports Sci. Rev.*, **15**: 95-151.

Smorto, M.P., Basmajian, J.V. 1979. In Baltimore, William & Wilkins. (ed. 2), *Clinical electroneurography.*

Wilbourn A.J. 1990. Electrodiagnostic testing of neurologic injuries in athletes. *Clin. Sports Med.*, **9**: 229-245.

Effect of Surface Spinal Stimulation (SSS) on H-reflex in Normal Individuals

Narkeesh[1], A., Navroop kaur[2], N. & Sharma[3], S.

[1]Associate Professor, Email: narkeesh@gmail.com, [2 & 3] Post Graduate Students,
Department of Physiotherapy, Punjabi University, Patiala-147002, Punjab, India

Abstract

Surface spinal stimulation is a well known technique that uses electrical currents in order to activate nerves and innervating muscles, it is one of the primary tools used to restore functions in various neurological disorders by reducing spasticity. There are many previous studies where surface spinal stimulation has been used in various neurological disorders and purposes but still there is no study to explain how surface spinal stimulation influences on monosynaptic reflex. The present study has used 2500Hz as a carrying frequency and 20 Hz as a beat frequency. Electrodes are attached 5 cm apart at the para spinal area at the T10-L2 level and electrode size (9x4.5 cm). The present study applied medium frequency currents to produce only sensory stimulation and was applied for duration of 45 minutes. H reflexes are taken pre and post spinal stimulation measure the soles muscle. The mean, standard deviation and t value for all the variables were calculated and was concluded that spinal stimulation had a significant effect on monosynaptic reflex as there was significant decrease in H/M ratio and H amplitude, however, there elongation of H latency but not up to significant levels was observed.

Key words: H-Reflex, Surface Spinal Stimulation

Introduction:

Electrical Stimulation is a technique that uses electrical currents to activate nerves innervating muscles and is primarily used to restore functions in people with disabilities. Surface Spinal Stimulation (SSS) is a form of electrical stimulation, and is used to influence the activity of nerve root fibers under the Para vertebral muscle through the surface electrodes applied over the skin of Para vertebral muscles *(Wang et al, 2000)*. SSS is the process of stimulating the spinal cord with various electrical currents in order to produce stimulation and reduction in spasticity at the corresponding level of body segment. Spinal cord electrical stimulation is used in cerebral palsy and multiple sclerosis in reducing spasticity in the majority of subjects along with improvement in bladder function, respiratory function, volitional control; active and passive movement and mood state with carry over effects lasting from 30 minutes to 24 hours *(Hazelwood et al, 1994)*.

The H-reflex (Hoffmann reflex) is a reflectory reaction of muscles after electrical stimulation of sensory fibers (Ia afferents stemming from muscle spindles) in their innervating nerves (for example, those located behind the knee). The H-reflex test is performed using an electric stimulator, which gives usually a square-wave current of short duration and small amplitude (higher stimulations might involve alpha fibers, causing an F-wave, compromising the results), and an EMG set, to record the muscle response. That

response is usually a clear wave, called H-wave, 28-35 ms after the stimulus, not to be confused with an F-wave. An M-wave, an early response, occurs 3-6 ms after the onset of stimulation. The H and F-waves are later responses. As the stimulus increases, the amplitude of the F-wave increases only slightly, and the H-wave decreases, and at supramaximal stimulus, the H-wave will disappear. The M-wave does the opposite of the H-wave. As the stimulus increases the M-wave increases. There is a point of minimal stimulus where the M-wave is absent and the H-wave is maximal. The present study put on efforts to explore the effects of surface spinal stimulation in 25 normal adolescents and to know how it influences the monosynaptic reflex.

Materials and Methods

Study was performed on 25 subjects taken from the Punjabi University, Patiala under the age group of 20-25 years. It was an experimental study which was performed in the Department of Physiotherapy. Study was performed in accordance with ethical considerations of the institute and their consent was taken prior to the study. Before beginning with the procedure, the subjects who were selected on the basis of convenient sampling by applying inclusion criteria and were explained the entire procedure in detail. The inclusion criterion was Male subjects of age 20 to 25 years, with normal BMI between 19 to 25 kg/m^2 and with height 165-190 cm are included. The body temperature ranges between 36-37 °C, leg length from 27-49 cm and absence of any systemic, physical or neurological problem. The Exclusion Criteria was any sensory or motor impairment, space occupying lesion, upper motor neuron or lower motor neuron symptoms, mixed symptom rigidity, flaccidity and spasticity, any neurological and cognitive deficit, any radiculopathy and neuropathy, any recent surgery on back, hip, knee, height below 165cm or above 190cm, leg length less than 27 cm or more than 49 cm and subjects with BMI more than 25 or less than 19. Of all the 25 subjects, H-reflex was recorded maintaining room temperature between 19-24°C on non-dominant side in prone lying. Recording and reference electrodes were placed at the soleus muscle and sub maximal stimulation was given at popliteal crease. Surface Spinal Stimulation was delivered by pulses that were generated from amplitude modulated alternating current of a carrier frequency of 2500 Hz, and modulated to deliver beat at a frequency of 20 Hz. For application, an electrode was placed on each side of the spine (5cm apart) over the paravertebral skin at the twelfth thoracic and first lumbar vertebral levels. The self-adhesive electrodes of rectangular shape and size of 5×9cm were used. The stimulation amplitude was adjusted for each subject to produce only sensory stimulation and it was applied continuously for 45 minutes *(Wang et al., 2000).*

Surface spinal stimulation was then applied at T12 & L1 level for 45 minutes in prone lying and again H-reflex was recorded in prone lying. Pre and post stimulation values of latency of H-reflex (ms), H/M ratio and mplitude of H-wave (mV) were taken. The data was collected and analyzed.

Results

Statistics application was performed by using SPSS 16. Results were calculated by using 0.05 level of significance. Table 1 shows the mean and standard deviation of age. The mean and

standard deviation of age is 22.36±1.57 years.

Table 1: Mean and SD of Age

Demographic	Mean	SD
AGE	22.36	1.57

Further, it was found that glycated haemoglobin (HbA1c) was positively and significantly related with total cholesterol (r=0.29), high density lipoproteins (r=0.19), triglycerides (r= 0.26) and very low density lipoproteins (r=0.16). However, low density lipoproteins (r=0.5) did not show any significant relationship with HbA1c.

Table 2. Mean and SD of H-Latency, H/M and H amplitude at Pre and Post interval for the subjects included in the study

Variable	Pre Stimulation		Post Stimulation	
	Mean	SD	Mean	SD
H-Latency	28.46	0.93	28.10	1.22
H/M	1.76	0.77	1.10	0.65
H Amplitude	4.60	2.07	4.05	1.87

Table 2 describes the mean and standard deviation of H-latency, H/M and H amplitude at Pre and Post interval. The mean and standard deviation of H-latency pre- stimulation is 28.46±0.93 and post stimulation is 28.10±1.22, H/M is 1.76±O.77 and 1.10±0.65 and of H amplitude is 4.60±2.07 and 4.05±1.87.

Table 3: Comparison of mean value for H-Latency between Pre and Post interval for the subjects included in the study

Variable	Pre Stimulation Vs Post Stimulation	
	t value	P value
H-Latency	1.982	P > 0.05
H/M	6.567	P < 0.05
H Amplitude	2.279	P < 0.05

Table 3 shows the comparison of mean value for H-latency between pre and post Interval for subjects included in the study. The t value for H-latency pre vs. Post Stimulation is 1.982 at P>0.05, t value for H/M pre vs. post is 6.567 at P < 0.05 and for H amplitude pre vs. post is 2.279 at P < 0.05.

Discussion

Surface spinal stimulation is important intervention measure used in various neurological disorders like stroke for reducing spasticity (Walker, 1982). The possible physiological mechanism of tone reduction could be by the indirect activation of golgi tendon organ through electrically elicited contraction, there is also reported evidence that low threshold afferent input can change the activity in interneurons and alpha motor neurons by segmental propriospinal or supraspinal pathways *(Visser and Zilvold, 1978)*. Surface spinal stimulation has pronounced effects in H reflex, which is an electrically induced reflex analogues to mechanically induced spinal stretch reflex, its arc is similar to spinal stretch reflex except that it bypasses the muscle spindle, and therefore it is a valuable tool for assessing mono synaptic reflex activity in spinal cord. Thus, it is reliable tool for assessment of muscle tone through the excitability of alpha motor neuron *(Palmieri et al, 2004)*.

In the present study, to find the effect the effect of surface spinal stimulation in H-reflex, only male subjects were taken because the significant role of sex in H-reflex has already been elicited *(Huang et al, 2009)*. H-reflex has also shown modifications due to variations in age and leg length

(Robinson et al, 1988). So in present study, considering the age factor, subjects of age group 20-25 years and leg length in present study was controlled between 27 and 49 cm. H – reflex latency shows increase with cooling and decrease with warming *(Riccardo et al, 2001).* So, in present study room temperature was monitored from 19-24°C. As Body Mass Index has also shown to influence the conduction changes *(Buschbacher, 1999),* the subjects with normal BMI (19-25 Kg/m^2) were included in the study.

In the present study, surface spinal stimulation of carrier frequency of 2500 Hz and beat frequency 20 Hz was given through the surface electrodes of size 4.5 x 9 cm, which were placed 5 cm apart on each side of spine, as explained by *Wang et al (2000)*. In order to find the changes in H-latency, H/M ratio and H-amplitude on applying the Surface Spinal Stimulation an experimental was conducted on 25 subjects. Surface Spinal Stimulation was applied for 45 minutes over T_{12} and L_1 Para vertebral skin and then pre and post stimulation readings of H-latency, H/M ratio and H-amplitude were collected and analyzed through SPSS 16. The results revealed that there are changes in the nerve excitability, H amplitude and H/m ratio and there is significant influence of Surface Spinal Stimulation on monosynaptic reflex there is significant decrease in H/M ratio (t value : 6.67) and H amplitude (t value : 2.279), however there is elongation of H latency but not up to significant level.

Though the difference in the pre and post values was not statistically significant but there was considerable effect of spinal stimulation on H-latency. There has been less literature available to explain the mechanism behind the changes in value of H-latency after surface spinal stimulation. A decrease in H-latency value Post stimulation is explained by *Wang et al., (2000),* he stated that repetitive sensory stimulation causes sensory habituation due to generalized desensitization of spinal pathways, thus, it results in suppression of interneuron and hence the results were non-significant.

The t-value for H/M was 6.567 at $P < 0.05$ which was significant. These results supported by earlier studies, that there were significant changes in pre and post stimulation amplitude and H/M values. The possible mechanism involved in reduction of the mean of H/M ratio is that the spinal electrical stimulation induces lasting changes in I_a fibre motoneuron synapse, thus spinal stimulation is valuable measure in modulating spinal motor pathways.

The t-value for H-amplitude was 2.279 at $P < 0.05$ which was significant. The results are in accordance with the studies conducted by *Hayashi et al, (1992)* concluded that there is suppression of the H-reflex amplitude after the application of electrical stimulation. *Gruber et al, (2007)* also investigated that there is reduction in peak to peak amplitude of stretch reflex and H/M ratio after the application of electrical stimulation for 30 minutes over the surface of muscle.

The study also considered certain limitations; the study was done only on normal males on narrow age group 20–25 years. The sample size was small. Skin resistance was not uniformly controlled, only application of spirit to reduce the skin resistance was done. These limitations have made a scope for future study in the same area. The future scope is Study can be done on large sample size and both sexes. Study can be done on

individuals with tonal abnormalities along with various neurological disorders. Wide range of frequencies and duration of Surface Spinal Stimulation can be taken to find various effects in monosynaptic reflex.

Conclusion

The present study concluded that surface spinal stimulation has significant influence over the monosynaptic stretch reflex. The present study found that surface spinal stimulation of medium frequency current with a beat frequency of 20 Hz had an inhibitory influence over the monosynaptic stretch reflex and it also significantly reduced H/M ratio and H amplitude along with prolonged H latency but not up to the mark of significance.

References

Buschbacher, R. 1999. Normal range for H-reflex recording from the calf muscle S., *Am. J. Phys. Med. And Rehab.*, 77 : 6.

Gruber M, Taube W, Gollhofer A, Beck S, Amtage F, Schubert M. 2007. Training-specific adaptions of H- and stretch reflexes in human soleus muscle. *J. Mot. Behav.*, **39:** 68–78.

HaHyashi, R., Tako, Kenji., Tokuda, Takahiko. and Yanagisawa, Nobuo. 1992. "Comparison of amplitude of human soleus H-reflex during sitting and standing", *Neuroscience research, 13(3):* pp 227-233.

Hazelwood, M. E., Brown, J. K., Rowe, P. J. 1994. The use of therapeutic electrical stimulation in the treatment of hemiplegic cerebral palsy. *Dev. Med. Chil. Neurol.,* **36:** 661-673.

Huang, C.R., Chang, W.N., Chang, H.W., Tsai, N.W., and LU, C. 2009. Effects of Age, Gender, Height and Weight on late responses and nerve conduction study parameters. *Acta. Neurol. Taiwan*, **18:** 242-249.

Palmieri, R.M., Ingersoll, C.D. and Hoffman, M.A. 2004. The Hofmann Reflex: Methodologic considerations and applications for use in sports medicine and athletic training research", *J. Ath. Train.*, **39(3):** 268-77.

Riccardo, M., Giovani, B.S., Aido, M.,Vitaliano, F.M., Lucio, P. 2001. Recruitment curve of the Soleus H-reflex in chronic back pain and lumbosacral radiculopathy. *BMC Muscle Skeletal Disorders*, **4:** 11.

Robinson, C., Kett, N., Bolam, J. 1988. Spasticity in Spinal Cord injured patients: 2. Initial measures and long term effects of surface electrical stimulation. *Arch. Phys. Med. Rehabil.*, **69:** 862-8.

Visser, S.L., Zilvold, G. 1978. EMG analysis in hemiplegic patients treated by means of FES of the Peroneal nerve. *Scand. J. Rehab. Med.*, **10:** 75-9.

Walker, J.B. 1982. Modulation of Spasticity : Prolonged Suppression of a Spinal reflex by electrical stimulation. *Science*, **216:** 203-4.

Wang, R.Y., Chan, R.C., Tsai, M.W. 2000. Effect of thoraco-lumbas electric sensory stimulation on knee extensor spasticity of persons who survived cerebrovascular accident (CVA). *J. Rehabil. Res. Dev.*, **37(1):** 73-9.

Efficacy of Neuro - Developmental Therapy Based Gait Training in Correction of Gait Pattern of Post Stroke Hemiparetic Patients

Vij[1], J.S. & Multani[2], N.K.

[2]Professor, Dept of Physiotherapy, Punjabi University, Patiala-147001, Punjab

Abstract

The purpose of the study is to compare the efficacy of Neuro- Developmental Therapy (NDT) based gait training with conventional physiotherapy in re-education of gait in post stroke hemiparetic patients. 24 post stroke hemiparetic subjects (n=24, males=20, females=4) aged 40-70 yrs (mean age 56.13 yrs) affected for a period of 4-6 weeks and having ability to walk, with or without walking aid, were included in the study. All the subjects were assessed for step length, stride length, cadence, gait velocity and pressure areas in different parts of the foot using Harris mat. The quality of gait was assessed using Wisconsin Gait Scale (WGS). All the subjects were conveniently divided into two groups viz Group A and Group B. Group A received NDT based gait training along with conventional physiotherapy whereas Group B received only conventional physiotherapy for a total period of 8 weeks. After statistical analysis, a significant improvement was observed in step length affected (t= 6.82, t= 4.25), step length unaffected (t= 7.27, t= 4.78), stride length (t= 7.63, t= 4.41), gait velocity (t= 3.34, t= 4.69), cadence (t= 4.56, t= 6.08) and WGS scores (t= 6.44, t= 5.86) in both the groups. Whereas significant decrease in the spasticity (MAS–Hip, t=3.46 , MAS–Knee, t=3.73, MAS–Ankle, t=3.73) was only observed in the group receiving NDT based gait training along with conventional physiotherapy (Group A). However, no statistically significant difference was observed in the high and low pressure areas of upper, middle and lower parts of foot in both the groups after the intervention. In between comparison of the two groups showed a significant difference in the improvement in the step length of affected side (t=3.94), step length of unaffected side (t=4.31), stride length (t=5.1) as well as WGS scores between the two groups. The present study has highlighted that both, the conventional physiotherapy as well as addition of NDT based gait training, are effective in improving the step length, stride length, cadence, velocity and WGS scores in post stroke hemiparetic patients. But in comparison to conventional physiotherapy alone, addition of NDT based gait training is more effective in improving step length, stride length, spasticity and WGS scores in these patients.

Key words: Stroke, Hemiparesis, NDT based gait training, Conventional physiotherapy, Harris mat

Introduction

Stroke is the leading cause of adult disability and inpatient rehabilitation admissions *(AHA, 2003, DeJong et al, 2005)*. It is the most important single cause of disability in people living in their own home *(Hankey, 1999)*. According to International Stroke trial reports, at 6 months after stroke, about 20 % are dead, 50 % are independent and 30 % are dependent in self care *(Weir et al, 2001)*. An estimated 70% of the patients who survive a stroke are unable to walk independently during the first three to four weeks post stroke. Dependence in mobility is one of the primary reasons of admission for inpatient rehabilitation after stroke. Much effort goes into helping these patients regain the ability to walk at least in the home prior to discharge. In

spite of these efforts, approximately 35% of survivors with initial paralysis of the leg do not regain useful walking function, and 25% of all survivors are unable to walk without full assistance *(Akhan et al, 1995).* Several studies show that most of the motor recovery following stroke occurs within the first 3 months post-stroke and that the initially steep recovery curve levels at about 6 months to a year post-stroke *(Skilbeck et al, 1983)*.

Stroke patients show various kinds of deficits in perception, muscle strength, motor control, passive mobility, sensation, tone and balance. These impairments have significant effects upon walking ability. Walking is possible for the majority of patients following stroke, but it is very rare that it returns to normal *(Jorgenson et al, 1995).* Although the reported figures vary, approximately 50-80% of patients who survive a stroke will eventually regain some degree of walking ability *(Skilbeck et al, 1983).* Nevertheless, outcome studies on rehabilitation of patients who are stroke survivors reveal that 93% of patients have difficulty in walking independently in the community after being discharged from hospital.

Thus, the ability to walk is the major factor that determines whether the patient will return to the previous level of activity or not, because independent ambulation is essential for community reintegration and social participation. Thus, gait training accounts for a large proportion of time spent in stroke rehabilitation. Gait correction and re-education, therefore, is an important physical therapy intervention for patients following stroke. Therefore, basic purpose of any rehabilitation process in stroke is to make the person ambulatory and thus reduce his disability. This apparently indicates that there is a dire need to analyze the gait patterns of these patients so as to formulate and then effectively execute the strategies to correct and re-educate it.

The walking patterns of both individuals without mobility problems *(Winter et al, 1990)* and patients with hemiplegia have been well documented *(Olney & Richards, 1996)*. The gait of people following stroke is characterized by problems with generating, timing, and grading of muscle activity, hypertonicity, and mechanical changes in soft tissues *(Olney & Richards, 1996)*. Gait speed, stride length, and cadence are lower than normal values *(Olney & Richards, 1996)*. Common kinematic deviations during the stance phase of the gait cycle are decreased peak hip extension angles, decreased lateral pelvic displacement, changed knee extension, and decreased plantar-flexion angles *(Moseley et al, 1993).* Common kinematic deviations during the swing phase of the gait cycle are decreased hip flexion, knee extension, and dorsiflexion *(Moore et al, 1993)*. Kinetic characteristics and abnormal motion of the unaffected side have not been commonly documented in patients following stroke ((*Olney & Richards, 1996; Quervain et al, 1996).*

Motor rehabilitation of adults with hemiplegia uses a number of physiotherapy approaches developed by authors such as Bobath, Rood, Kabat, Brunnstrom and Perfetti. The Bobath concept, also known as neurodevelopmental treatment, is a widely used approach in the rehabilitation of hemiparetic subjects in many countries. Despite 50 years of clinical use, its

effectiveness is questionable *(Paci, 2003)*. Till now, very few researches have been done exploring the efficacy of NDT in hemiparetic patients, particularly in gait correction and rehabilitation. Whatever studies have been done, they have been case reports comprising one or two subjects and do not clearly support NDT as an effective therapeutic procedure in gait rehabilitation.

Thus, most effective treatment strategies to use in gait re-education following stroke, seems to remain unknown *(Ashburn et al, 1993)*. Given the popularity of NDT in treatment of adults with post-stroke hemiplegia, an overview of effective evidence for the NDT in rehabilitation of post- stroke hemiplegic patients is necessary in order to justify its wider use by physiotherapists. This study describes gait re-education based on the NDT concept, which is one of the leading treatment approaches in Europe for rehabilitation of patients with stroke. The primary aim of this study is to investigate the efficacy of NDT based gait training in improving both, the quantitative as well as qualitative gait parameters in post stroke hemiparetic patients.

Materials and Methods

Post stroke hemiparetic patients who were in stable condition and could walk, with or without gait aid, were recruited for this study. Patients who met the following entry criteria were included; (i) unilateral hemiplegia caused by cerebral hemisphere stroke other than trauma, brain tumor or secondary etiology; (ii) affected for a period of 4-6 weeks; (iii) good cooperation and compliance in gait analysis; (iv) ability to walk for more than 10 m; (v) absence of cerebellar or brain stem strokes; (vi) lack of other peripheral or central nervous system dysfunction; (vii) having no more than one CVA prior to testing; (viii) absence of active inflammatory or pathological changes in the joints of the lower limbs, limb length discrepancy, or foot deformities (such as pes valgus, pes cavus, hallux valgus or hallux rigidus) in the previous 6 months; (ix) lack of severe visual spatial dysfunction; (x) no active medical problems. The study was approved by the Institutional Ethical Committee of Punjabi University, Patiala. All patients received an explanation of the study and gave informed consent before enrolment. A total of 24 patients (20 males and 4 females), with an average age of 56.13 years (range 40-70 years), were included in this study.

The gait pattern was assessed within a week after the patient had resumed walking, which was defined as the ability to walk ten to fifteen meters. All the subjects were instructed to walk along a smooth, horizontal 10 m- long walkway at a comfortable speed. Only the middle five steps were evaluated to avoid the variable steps associated with initiation and termination of gait. The gait velocity, step length, stride length, cadence and foot pressure areas were measured for quantitative gait analysis.

The step length (cm) was measured from the geometrical heel centre of the current footprint to the same of the previous footprint on the opposite foot, and the stride length (cm) from the line of progression between the heel points of two consecutive footprints of the same foot. The walking velocity (cm/s) was obtained after dividing the recorded distance by the ambulation time. The cadence was calculated by asking the patient to walk for one minute through a straight pathway with self-selected speed

and then calculating the number of steps taken during one minute. The areas of low and high pressure (in upper, middle and lower part of foot) were determined using foot imprints on Harrison mat. Each foot imprint was divided into three parts – upper part, middle part and lower part. The Wisconsin Gait Scale (WGS) was used for qualitative gait analysis and modified Ashworth scale for assessing the spasticity in specific muscle groups.

All the subjects were conveniently divided into two groups – Group A and Group B. Group A received NDT based gait training along with conventional physiotherapy whereas Group B received only conventional physiotherapy.

Each patient was given a physiotherapy program of 8 weeks duration, with 5 physiotherapy sessions per week, each therapy session lasting for about 40 minutes. All the subjects were reassessed for the above parameters again after the completion of 8 weeks of intervention.

Statistical analysis

A paired t-test was performed to analyze the difference between the various gait variables in both the groups after the intervention. An independent t-test was performed to analyze the difference in the changes in these gait variables in between the two groups.

Results

Table 1.Mean scores and improvement of the gait parameters in the two groups

	Group A (NDT and Conventional Physiotherapy)				Group B (Conventional Physiotherapy)			
Parameters	**Mean (Before)**	**Mean (After)**	**t-value**	**p-value**	**Mean (Before)**	**Mean (After)**	**t-value**	**p-value**
Step length affected (cms)	**27.36**	**37.82**	**6.82**	**< 0.0001**	**18.45**	**22**	**4.25**	**= 0.0017**
Step length unaffected (cms)	**18.27**	**32.36**	**7.27**	**< 0.0001**	**10.09**	**14.91**	**4.78**	**= 0.0007**
Stride length (cms)	**46**	**70.18**	**7.63**	**< 0.0001**	**28.55**	**35.36**	**4.41**	**= 0.0013**
Cadence	**53.26**	**73.45**	**4.56**	**= 0.0010**	**50.36**	**62.55**	**6.08**	**= 0.0001**
Gait velocity (cm/s)	**25.03**	**35.57**	**3.34**	**= 0.0075**	**21.37**	**26.83**	**4.69**	**= 0.0009**
MAS Score – Hip	**0.82**	**0.27**	**3.46**	**= 0.0061**	**0.73**	**0.55**	**1.49**	**= 0.1669**
MAS Score – Knee	**1.36**	**0.64**	**3.73**	**= 0.0039**	**1.36**	**1.18**	**1.49**	**= 0.1669**
MAS Score – Ankle	**1.64**	**0.91**	**3.73**	**= 0.0039**	**1.73**	**1.55**	**1.49**	**= 0.1669**
WGS Score	**28.90**	**20.52**	**6.44**	**< 0.0001**	**29.69**	**26.75**	**5.86**	**= 0.0002**
Low pressure area – Upper part (%)	**43.52**	**37.47**	**2.21**	**= 0.0518 (NS)**	**49.77**	**39.26**	**1.74**	**= 0.1130 (NS)**
High pressure area – Upper part (%)	**56.48**	**62.53**	**2.06**	**= 0.0664 (NS)**	**50.23**	**60.74**	**1.74**	**= 0.1128 (NS)**
Low pressure area – Middle part (%)	**51.98**	**43.63**	**1.90**	**= 0.0858 (NS)**	**39.82**	**51.39**	**1.34**	**= 0.2099 (NS)**
High pressure area – Middle part (%)	**48.02**	**56.37**	**1.90**	**= 0.0862 (NS)**	**60.18**	**48.61**	**1.35**	**= 0.2078 (NS)**
Low pressure area – Lower part (%)	**21.56**	**12.89**	**1.43**	**= 0.1843 (NS)**	**13.02**	**22.58**	**1.43**	**= 0.1840 (NS)**
High pressure area – Lower part (%)	**78.44**	**87.11**	**1.43**	**= 0.1843 (NS)**	**86.98**	**77.42**	**1.43**	**= 0.1840 (NS)**

The various changes in the gait parameters, after the intervention, in both the groups are shown in Table 1 and Table 2.

Table 2. Comparison of mean improvement in the gait parameters after the intervention between the two groups

Parameters	Mean of difference - Group A (NDT and Conventional Physiotherapy)	Mean of difference - Group B (Conventional Physiotherapy)	t-value	p-value
Step length affected (cms)	10.45	3.73	3.94	0.0008 (S)
Step length unaffected (cms)	13.91	4.82	4.31	0.0003 (S)
Stride length (cms)	24.12	6.82	5.1	0.0001 (S)
Cadence	20.36	12.18	1.7	0.1050 (NS)
Gait velocity (cm/s)	10.51	5.45	1.51	0.1473 (NS)
WGS Score	8.41	4.04	2.28	0.0335 (S)

The affected step length (t-value 6.82, p – value <0.0001), unaffected step length (t-value 7.27, p – value <0.0001) as well as stride length (t-value 7.63, p – value <0.0001) increased in the group receiving NDT along with conventional physiotherapy (Group A) as well as in the group receiving only conventional physiotherapy (Group B) (Affected Step length t-value 4.25, p –value 0.0017) (Unaffected Step length t – value 4.78, p-value 0.0007) (Stride length t-value 4.41, p –value 0.0013). The gait velocity and cadence also improved in the group A (Gait velocity t-value 3.34, p –value 0.0075) (Cadence t-value 4.56, p –value 0.0010) as well as in Group B (Gait velocity t-value 4.69, p –value 0.0009) (Cadence t-value 6.08, p –value 0.0001). There also occurred significant improvement in WGS scores in both the groups (Group A t-value 6.44, p –value <0.0001) (Group B t-value 5.86, p –value 0.0002). But significant reduction in spasticity (MAS–Hip, t–value 3.46, MAS–Knee, t – value 3.73, MAS–Ankle, t- value 3.73) was only observed in the Group A. However, no statistically significant difference was observed in the high and low pressure areas of upper, middle and lower parts of foot in both the groups after the intervention.

There was a statistically significant difference in the changes in the step length of affected side (t-value 3.94, p – value 0.0008), step length of unaffected side, (t-value 4.31, p –value 0.0003), stride length (t-value 5.1, p –value 0.0001) and WGS scores (t-value 2.28, p –value 0.0335) between the Groups A and B.

Discussion

Regaining independent walking ability forms a major goal of all rehabilitation programs and is, indeed, of great significance to patients who have suffered a stroke. Rehabilitation therapy after a stroke is costly and can be justified only if the therapy program is appropriate and if recovery would not occur naturally.

Hemiparetic gait is characterized by slow and asymmetric steps with delayed and disrupted equilibrium reactions and reduced weight bearing on the paretic limb *(Perry, 1992, Yavuzer et al, 2001, Yavuzer & Ergin, 2002)*. Restoration of normal movements of the trunk, pelvis, and lower extremity, and improved weight bearing on the paretic side while walking, are some of the most important goals of stroke rehabilitation *(Roth & Harvey, 2000)*. Therefore, the present study was conducted to evaluate the efficacy of two treatment approaches in correction and re-education of gait

patterns of post stroke hemiparetic patients.

The findings of present study has demonstrated a significant improvement in various gait parameters such as step length of affected side, step length of unaffected side as well as stride length in both the groups A and B, indicating that both approaches, NDT based gait training in addition to conventional physiotherapy as well as conventional physiotherapy alone, are effective in improving these gait parameters in post stroke hemiparetic patients. This can be attributed to the fact that in both the groups, gait training helped in achieving more weight bearing on the affected side and corrected the asymmetry of steps as well as gait pattern in these patients. The rehabilitation program given to the patients in this study reduced the balance deficiencies and difficulty in moving the body over an unstable limb. The basic reason for short step and stride length in hemiparetic patients is that the patients spend less time on the paretic side as compared to the non paretic side. Therefore in both the groups, the exercises were designed in such a way that the patients were made to spend more time in stance on the paretic side than on the unaffected side. This resulted in the increased step length and stride length in both the groups.

However, the study also reveals that NDT based gait training in addition to a conventional physiotherapy program provides more benefit than a conventional stroke rehabilitation program alone, in improving these gait parameters. These findings could be explained on the basis of concept of NDT that considers "abnormal tone" and "abnormal coordination of movement patterns" to be the main problems of patients with hemiparesis, as both of these problems, were effectively addressed in the present study. This was manifested by statistically significant reduction in spasticity in the hip adductors, knee extensors and ankle plantar flexors in the patients who received NDT based gait training. It is reasonable to believe that this reduction in spasticity or better said, normalizing tone, is the necessary preparation for practicing functional activities such as walking.

To correct the problem of "abnormal coordination of movement patterns", in the NDT group of present study, more emphasis was given on exercises aimed at developing selective motor control, enhancing balance, righting and equilibrium reactions as well as discouraging stereotyped mass movement patterns. Additionally, handling techniques were used to correct alignment, to assist movement that the patient struggles to perform independently, and to block atypical movements. This might have reduced the patient's effort during movement, thus normalizing tone and producing more selective movement as opposed to stereotypical mass patterns.

Thus, facilitation of selective control of movement, achieved by the re-education of basic movement patterns of the trunk, the pelvis, and the limbs, was a key feature, used in the NDT approach. This probably resulted in more significant improvement in step length and stride length in the group receiving additional NDT. The work done by *Davies (2000)* further confirms the fact that commonly used rehabilitation programs such as NDT are specifically focused on restoring normal gait with a symmetrical pattern.

Conversely, there are certain researchers, though limited in number, who did not find any significant effect in correction of gait after application of NDT. For example, the findings of *Sheila et al (2006)* did not support the hypothesis that the Bobath approach restored more normal movement patterns to the gait cycle *(Lennon et al, 2006)*. Similarly, *Hesse & co-workers* found no significant improvement in gait symmetry after an intensive four weeks inpatient rehabilitation program based on a neuro developmental technique *(Hesse et al, 1993, Hesse et al, 1994)*. However, these studies were hampered by small sample size, execution at a single site, and the lack of baseline evaluation. They reported that tone-inhibiting manoeuvres and exercises in sitting and standing dominated therapy sessions, with little time spent on walking practice. On the contrary, gait-specific practice was a key feature of the NDT based gait training described in this study. The reports of many authors support these findings *(Carr & Shepherd, 1994)*.

Walking velocity was another important characteristic of the gait of hemiparetic patients, that was given due consideration in the present study. It has been reported as a reliable and responsive predictor of functional status. Walking velocity is a preferred outcome parameter for hemiparetic gait research as it is easy and reliable to measure *(Richards et al, 1995)*. Slow walking velocity in hemiparetic patients has been attributed to a lack of selective motor control and poor balance. However, unfortunately, rehabilitation programs do not mainly focus on increasing velocity fearing that it may cause a more abnormal gait pattern and result in safety problems. The findings of the present study have indicated that, after rehabilitation, walking velocity improved in both the groups. Both NDT based gait training as well as conventional physiotherapy, increased the time spent on the affected side and subsequently smoothened the forward progression of the extremity. This might have resulted in the possible improvement in walking velocity after the rehabilitation program in both the groups. This increase in walking velocity can also be attributed to the fact that there occurred improvement in motor control as well as inhibition of abnormal movement patterns and spasticity. Thus, the cumulative effect of increase in step length, stride length, cadence and most importantly motor control resulted in increasing gait velocity of hemiparetic patients. But the comparison between the two groups showed that addition of NDT based gait training to conventional physiotherapy program is equally effective in comparison to conventional physiotherapy program alone, in improving the gait velocity in post stroke hemiparetic patients. These findings are in agreement with *Brock et al (2011)* who documented short-term benefit for using interventions based on the Bobath concept for improving walking velocity in people with stroke. Improvement in spatio-temporal and weight bearing symmetry of gait provide an important clinical marker of recovery in rehabilitation as they are associated with better motor functioning and functional independence *(Hsu et al, 2003, Yang et al, 2005)*.

It was interesting to observe in the present study that the improvement in the gait pattern was not only limited to quantitative gait parameters. Rather, there occurred statistically significant improvement in the quality of the gait pattern too, which is evident from the

improvement in WGS scores. The Wisconsin Gait Scale (WGS) is a useful tool to rate qualitative gait alterations of post-stroke hemiplegic subjects and to assess changes over time during rehabilitation training *(Pizzi et al, 2007).* Although significant improvement was seen in both the groups, but it was evident that NDT based gait training in addition to conventional physiotherapy was more effective in improving the qualitative aspect of the hemiplegic gait in comparison to conventional physiotherapy alone. This can be attributed to the fact that in NDT program, the therapists use their handling techniques to correct alignment, to assist movement that the patient struggles to perform independently, and to block atypical movements. This resulted in the development of more selective motor control. Various exercises in the NDT group resulted in better recovery of movement of the affected side and functional activity.

The findings of present study also suggested that there occurred statistically insignificant difference in low and high pressure areas in the upper, middle and lower parts of the foot in both the groups. It proved that neither NDT based gait training nor conventional physiotherapy has any significant effect on the pressure areas in the various parts of the foot. Although the changes were statistically insignificant, there occurred some increase in the high pressure areas in the upper part of the foot, in both the groups, after the intervention, indicating a positive shift towards the normal values as seen in the healthy adults of same age group. Whereas in the middle and lower part of the foot, the insignificant increase in high pressure areas was only observed in the Group A, receiving NDT based gait training in addition to conventional physiotherapy. In the present study, there were variations in the magnitude of these parameters as reflected by the high standard deviations of the gait parameters and these variations may be due to the wide variability of gait after stroke. Further exploratory work of this nature is needed to arrive at a consensus on the changes occurring in the pressure areas of the foot in post stroke hemiparetic patiens.

In conclusion, addition of NDT based gait training is more effective in gait correction and re-education of gait of post stroke hemiparetic patients. NDT further helps in normalizing the gait pattern and as well as increasing the symmetry of gait in these patients.

References:

1. American Heart Association. Heart and Stroke Disease Statistics-2003 update. www.americanheart.org
2. DeJong, G., Horn, S.D., Conroy, B., Nichols, D., Healton, E.B. 2005. Opening the Black Box of Post stroke Rehabilitation: Stroke Rehabilitation Patients, Processes, and Outcomes. *Archv. Physic. Med. Rehab.,* **86 (12 Suppl):** 1-7.
3. Hankey, G.J. 1999. Stroke. How large a public health problem and how can the neurologist help? *Archv. Neurol.,* **56:** 748–754.
4. Weir, N.U., Sandercock, D.M., Lewis, S.C., Signorini, D.F., Warlow, C.P. 2001. Variations between countries in outcome after stroke in the International Stroke Trial (IST). *Stroke*, **32:** 1370-77.
5. Akhan, G., Kalkan, E., Cyrak, P., Pahin, B. 1995. The epidemiology of stroke in Isparta: 1990-1993. In Neurology and Public Health. Eds Kyrbap D, Leonardi M. Bitam Publications. 115-20.
6. Skilbeck, C.E., Wade, D.T., Hewer, R.L., Wood, V.A. 1983. Recovery after stroke. *J Neurol. Neurosurg. Psychiatry*; **46:** 5-8.

7. Jorgenson, H.S., Nakayama, H., Raaschau, H.O., Olsen, T.S. *1*995. Recovery of walking function in stroke patients: the Copenhagen Stroke Study. *Arch. Phys. Med. Rehabil.,* **76:** 27–32.
8. Skilbeck, C.E., Wade, D.T., Hewer, R.L., Wood, V.A. 1983. Recovery after stroke. *J. Neurol. Neurosurg. Psychiatry*, **46(1):** 5-8.
9. Winter, D.A., Patla, A.E., Frank, J.S., Walt, S.E. 1990. Biomechanical walking patterns changes in the fit and healthy elderly. *Phys. Ther.*, **70:** 340–347.
10. Olney, S.J., Richards, C. 1996. Hemiparetic gait following stroke, part 1: characteristics. *Gait & Posture*, **4:** 136 –148.
11. Moseley, A., Wales, A., Herbert, R., et al. 1993. Observation and analysis of hemiplegic gait: stance phase. *Aust. J. Physioth*, **39:** 259 –267.
12. Moore, A., Schurr, K., Wales, A., et al. 1993. Observation and analysis of hemiplegic gait: swing phase. *Aust. J. Physioth*, **39:** 272– 278.
13. De Quervain, I.A., Simon, S.R., Leurgens. S, et al. 1996. Gait pattern in the early recovery period after stroke. *J. Bone Joint Surg Am*, **78:** 1506–1514.
14. Paci, M. 2003. Physiotherapy based on the Bobath concept for adults with post-stroke hemiplegia: A review of effectiveness studies. *J. Rehabil. Med*., **35:** 2-7.
15. Ashburn, A., Partridge, C., De Souza, L. 1993. Physiotherapy in the rehabilitation of stroke: a review. *Clin. Rehab*., **7:** 337–345.
16. Perry, J. 1992. Gait analysis: Normal and pathological function. *Thorofare (NJ): Slack*; 224–226.
17. Yavuzer, G., Ergin, S. 2002. Effect of Arm Sling on Gait Pattern in Patients with Hemiplegia. *Arch. Phys. Med. Rehab*., **83:** 960-963.
18. Yavuzer, G., Gök, H., Ergin, S. 2001. Spatiotemporal and kinematic gait characteristics of stroke patients. *The J. Rheumat. Med. Rehab.*, **12:** 148-152.
19. Roth, E.J., Harvey, R.L. 2000. Rehabilitation of stroke syndromes. In: Braddom RL, ed. *Physical Medicine and Rehabilitation* 2nd ed. Philadelphia, Pa: WB Saunders, 1117-63.
20. Davies, P.M., 2000. *Steps to follow - the comprehensive treatment of patients with hemiplegia.* Springer-Verlag: Berlin Heidelberg.
21. Sheila, L., Ann, A. and Baxter, D. 2006. Gait outcome following outpatient physiotherapy based on the Bobath concept in people post stroke. *Disabil Rehabil*., **28(13-14):** 873-81
22. Hesse, S.A., Jahnke, M.T., Schreiner, C., Mauritz, K.H. 1993. Gait symmetry and functional walking in hemiparetic patients prior to and after a 4-week rehabilitation programme. *Gait & Posture*, **1:** 166 –171.
23. Hesse, S.A., Jahnke, M.T., Bertelt, C.M., et al. 1994. Gait outcome in ambulatory hemiparetic patients after a 4-week comprehensive rehabilitation program and prognostic factors. *Stroke*, **25:** 1999 –2004.
24. Carr, J.H., Shepherd, R.B. 1998. *Neurological Rehabilitation: Optimising Motor Performance*. Oxford, England: Butterworth-Heinemann.
25. Richards, C.L., Malouin, F., Dumas, F., Tardif, D. 1995. Gait velocity as an outcome measure of locomotor recovery after stroke. In: Craig, R., Oatis, C., editors. *Gait analysis: theory and applications*. St. Louis:Mosby, p. 355-64.
26. Brock, K., Haase, G., Rothacher, G., Cotton, S. 2011. Does physiotherapy based on the Bobath concept, in conjunction with a task practice, achieve greater improvement in walking ability in people with stroke compared to physiotherapy focused on structured task practice alone?: a pilot randomized controlled trial. *Clin. Rehabil.* Oct; **25(10):** 903-12.
27. Yang, Y.R., Yen, J.G., Wang, R.Y., Yen, L.L., Lieu, F.K. 2005. Gait outcomes after additional backward walking training in patients with stroke: a randomized controlled trial. *Clin. Rehabil.*, **19:** 264-73.
28. Hsu, A.L., Tang, P.F., Jan, M.H. 2003. Analysis of impairments influencing gait velocity and asymmetry of hemiplegic patients after mild to moderate stroke. *Arch. Phys. Med. Rehabil.,* **84:** 1185-93.
29. Pizzi, A., Carlucci, G., Falsini, C., Lunghi, F., Verdesca, S., Grippo, A. 2007. Gait in hemiplegia: evaluation of clinical features with the Wisconsin Gait Scale. *J. Rehabil. Med.,* **39(2):** 170-4.

Effect of Mulligan Stretching Techniques (TSLR AND BLR) on Biceps Femoris Muscle and Pelvic Rotation by Using Surface EMG and Bubble Inclinometer Respectively

Pratishtha, K. & Jagga, V.
Prem Physiotherapy and Rehabilitation College, Panipat, Haryana.

Abstract

This study was aimed to investigate and compare the effectiveness of two Mulligan techniques (TSLR and BLR that is Traction Straight Leg Raise and Bend Leg Raise) in improving the biceps femoris muscle performance, flexibility and pelvic rotation. A total of 90 asymptomatic female subjects of 18 to 30 years age were taken which were randomly divided into three groups, that is, two experimental (A and B) and one control group (C). The pelvic rotation ROM, passive straight leg raise ROM and EMG activity were checked in all three groups, after that the BLR, TSLR and Hamstring Self Stretch was provided to Group A, B and C respectively. All the previous readings were checked again. TSLR stretching technique was found to decrease the EMG activity and increase the range of pelvic rotation and passive straight leg raise more than other two groups.
Conclusion: Mulligan TSLR stretch is more effective than BLR stretch in improving biceps femoris muscle performance, flexibility and pelvic rotation.

Key Words: Asymptomatic, Passive Straight Leg Raise, Surface EMG, Hamstring

Introduction

EMG has become a useful tool for the investigation of the muscle activity and hence provides an efficient technique for improving the activity of the muscle. The amount of torque produced by a muscle depends on the number of motor units activated, the muscle length, and the moment arm of the muscle. These variables have been studied in various combinations, but there is lacks of studies that have investigated the relationship among EMG activity, and muscle length before and after stretching as stretching is also a muscle lengthening procedure. During maximal isometric contraction, an increase in integrated Electromyographic activity and a decrease in torque occurrs as the muscle is shortened, the opposite occurrs when the muscle is in lengthened positions. A greater difference in this relation is noted when the respective EMG activity and torque are held constant *(Lunnen et al, 1981)*.

Mulligan bent leg raise (BLR) technique has been described as a means of improving range of straight leg raise(SLR) in subjects with LBP and/or referred thigh pain *(Hall et al, 2006b)*. Mulligan has also described the traction straight leg raise (TSLR), which is said to improve the range of straight leg raise (SLR) in patients. Furthermore, it has been suggested that improving the range of SLR has a beneficial effect in restoring normal movement and reducing the degree of impairment due to low back dysfunction (*Hall et al, 2006a*). The present study has provided useful information about the internal as well as the visible changes in the muscle due to

the application of the mulligan (TSLR and BLR) techniques thus providing a better approach for the treatment. The purpose of the study was to establish the effect of TSLR and BLR mulligan technique on the biceps femoris muscle performance, flexibility and pelvic rotation.

Materials & Methods

90 asymptomatic female subjects were randomly assigned to each Group A (BLR Experimental group), Group B (TSLR Experimental group), and to Group C (Control group) using convenience random sampling method (30 in each group). The informed consents of subjects who were able to read and write simple English were collected with prior permission. Inclusion criteria included age of 18 to 30 years and female gender having positive passive knee extension test. The subjects were excluded on the basis of any previous medical history of lower limb injury or pain from last one year, previous fractures or surgery to back, pelvis, hip and knee, any pathological or inflammatory condition that could affect motion, pregnancy, general medical conditions like hypertension, diabetes and any neurological conditions. The pelvic rotation was checked first, by using bubble inclinometer during forward bending followed by hamstring flexibility using the PSLR test, a standard test shown to have a reliability of 0.97. The EMG (by the Neuroperfect 2 channel EMG NCV EP instrument) was then checked on biceps femoris muscle during the maximum isometric contraction produced against resistance of the repetition maximum of the subject on the DeLorme table. Group A, Group B, and Group C received three BLR, TSLR and hamstring self stretch respectively. After the completion of the stretching procedure, all pre-test readings of EMG, PSLR, and pelvic rotation were again recorded.

Results & Discussion

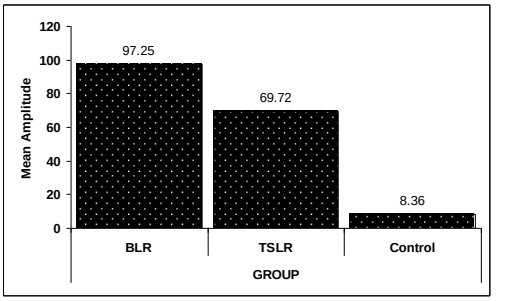

Figure 1: Comparison of change in EMG activity among the three groups

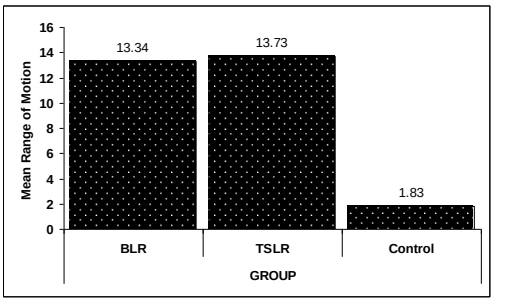

Figure 2: Comparision of change in PSLR motion among the three groups

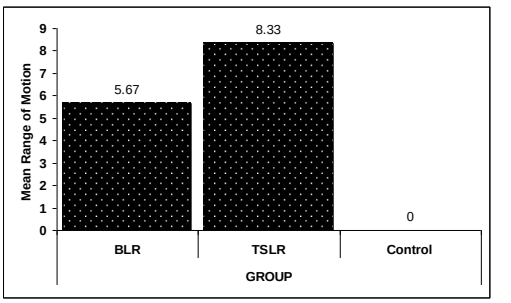

Figure 3: Comparision of change in Pelvic Rotation ROM among the three groups

Results were analyzed by using one way anova and paired t-test by using SPSS version 15. The within group analysis of the EMG showed that in Group A (BLR) there was an increase in EMG activity with a percentage of 22.52% and in Group

B (TSLR) there was a decrease in EMG activity by 14.64%, but no significant difference in Group C (Control) was observed. The PSLR within group analysis showed a significant difference between the pre and post readings in both groups. Group A (BLR) with an overall improvement of 23.68% and in Group B (TSLR) improvement is of 25.69% and in Group C (Control) that is of 3.29%. The within group analysis of the Pelvic Rotation also showed that in Group A (BLR) there was an overall improvement in range of pelvic rotation that is of 14.20% and of 18.20% in Group B (TSLR) but no difference in Group C (Control).

This study investigated the effectiveness of the two Mulligan techniques that is Traction Straight Leg Raise (TSLR) and Bend Leg Raise (BLR) in improving biceps femoris muscle performance, flexibility and pelvic rotation. The results of this study reveal that the TSLR (Traction Straight Leg Raise) stretch is more effective in improving muscle activity, flexibility and pelvic rotation than the BLR (Bend Leg Raise) and hamstring self stretch.

In the TSLR group the EMG activity decreased by 22.52%, thus suggesting improved muscle performance as decrease in muscle activity shows that muscle is able to do the same work with less recruitment of motor units thus rendering it more efficient, while in the BLR group the EMG activity increased by 14.64%. A study done by *Lunnen et al (1981)* also support these results who found that changes in the moment arm of a muscle appear to affect the production of EMG activity differently. During maximal isometric contraction, an increase in integrated electromyographic activity and a decrease in torque occurred as the muscle was shortened; the opposite occurred when the muscle was in lengthened positions. The TSLR group also showed a relatively greater increase in the straight leg raise ROM (25.69%) than the BLR group (23.68%). Thus it is in agreement to the results of the study done by *Lunnen et al (1981)*. Further the increase in the muscle length resulted in a decrease in the EMG activity thus rendering a muscle more efficient. There is also increase in the PSLR range in the BLR group, but alongwith it, the EMG activity has also been observed to increase. These observations are in agreement with the study done by *Hideaki et al, 2002). Hideaki & coworkers* found that the EMG activity of hamstring muscles during maximum isometric knee flexion varies with change in muscle length or joint angle. In this study the EMG activity has increased because of knee flexion, so this may be the reason of increase in the muscle activity in the BLR group as in the BLR stretch, the knee was in flexion thus leading to an increase in muscle activity.

The results of this study differ from the results of the study done by *Andersen et al (2010)* who reported that comparable high levels of muscle activation were obtained during resistance exercises with dumbbells and elastic tubing. In the present study the EMG activity was checked during the maximal resistance given by the DeLorme weights, but the EMG activity decreased in the TSLR group. The TSLR group also showed the increase in the straight leg raise range and pelvic rotation which are in accordance with the study done by *Bellew et al (2010)* who showed a positive correlation

between hamstring flexibility and pelvic rotation. It was also observed that total forward bending range is similarly influenced by hamstring flexibility. The increase in straight leg raise range and a decrease in the EMG activity in TSLR group may be due to the fact that during TSLR stretch, various receptors exert an inhibitory influence on lower limb alpha-motoneuron activity. Golgi tendon organs around the knee, hip and spine probably initiate various segmental reflex pathways during traction of the limb. Likewise, Golgi tendon organs are activated during large amplitude stretching movements such as SLR. This processing of information in the nervous system may inhibit the activity of the muscles being lengthened during SLR by dampening the afferent activity of type II muscle spindles or by decreasing motor neuron excitability via 1-b fibers. Hence, improvement in range of SLR may be directly related to inhibition of the hamstring muscles rather than changes due to stretch tolerance.

Conclusion

Based on the results of the present study, it is concluded that TSLR Mulligan stretch is better than BLR Mulligan stretch in improving the biceps femoris muscle performance, flexibility and pelvic rotation.

References

Andersen, L.L., Andersen, C.H., Mortensen, O.S., Poulsen, O.M., Bjørnlund, I.B.T. and Zebis, M.K. 2010. Muscle Activation and Perceived Loading During Rehabilitation Exercises: Comparison of Dumbbells and Elastic Resistance. *Phys. Therapy*, **90:** 538-549.

Bellew, S., Ford, H. and Emma Shere, E. 2010. The Relationship between Hamstring Flexibility and Pelvic Rotation around the Hip during Forward Bending. *The Plymouth Student Journal of Health & Social Work*, 2:19-29.

Fauth, M.L., Petushek, E.J., Feldmann, C.R. et al. 2010. Reliability of Surface Electromyography during Maximal Voluntary Isometric Contractions, Jump Landings, and Cutting. *J. Streng. & . Res.*, **24(4):** 1131-1137.

Hall, T., Beyerlein, C., Ulla Hansson, U., Lim, H.T., Odermark, M., Sainsbury, D. 2006a. Mulligan Traction Straight Leg Raise: A Pilot Study to Investigate Effects on Range of Motion in Patients with Low Back Pain. The *J. Man. & Manip. Ther.*, **14(2):** 95 – 100.

Hall, T., Hardt, S., Axel Scha, A., Lena Wallin, L. F. 2006b. Mulligan bent leg raise technique—a preliminary randomized trial of immediate effects after a single intervention. *Manual Therapy*, **11(2):** 130–135.

Hideaki, O., Ryo, Y., · Oyama, M., Akasaka, K. Ihashi, K., Yasunobu, H. 2002. EMG-angle relationship of the hamstring muscles during maximum knee flexion. *J. EMG Kinesiol.*, **12(5):** 399-406.

Lunnen, J.D., Yack, J., LeVeau, B.F. *1981.* Relationship Between Muscle Length, Muscle Activity, and Torque of the Hamstring Muscles *Phys. Ther*., **61:**190-195.

Marek, S.M., Cramer, J.T., A. Fincher, L., Massey, L.L., Dangelmaier, S.M., Purkayastha, S., Kristi, A Fitz, K.A., and Culbertson, J.Y. 2005. Acute Effects of Static and Proprioceptive Neuromuscular Facilitation Stretching on Muscle Strength and Power Output. *J. Athl. Train.*, **40(2):** 94–103.

O'Sullivan, K. Smith, S.M. and Sainsbury. D. 2010. Electromyographic analysis of the three subdivisions of gluteus medius during weight-bearing exercises. *Sports Med Arthrosc. Rehabil. Ther. Technol.*, **2:** 17.

Roseborrough, A., Lebec, M. 2007. Differences in static scapular position between rock climbers and a non-rock climber population. *North Am. J, Sports Phy, Therap.*, **2(1):** 44-50.

Sihvonen, T. 1997. Flexion Relaxation of the Hamstring Muscles during Lumbar-Pelvic Rhythm. *Archv. Med. Rehab.*, **78(5):** 486-490.

A Comparative Study of Player and Non- Player Students in Relation to Mental Health

Gahlawat[1], O.P. & Gahlawat[2], P.
[1]Prof, Department of Physical Education, Kurukshetra University.
[2]Assistant Professor of Physical Education & Sports, Govt. College for Girls, Chandigarh.

Abstract

The objective of this study was "To examine mental health dimensions between player and non- player students". Researcher took 50 boys and 50 girls ranging from 17 to 21 years for the study. In the present study sex and type of students have been treated as independent variable and mental health as dependent variable. The respective groups of boys and girls were adminstered the mental health inventory by *Jagdish and Srivastava (1983).* It was observed that - male player subjects are found more positive self-evaluation, integration of personality, autonomy and environmental mastery than male non player subject, and over all mental health there is significant difference between male player and male non -player subjects. Female Player subjects are found more positive self-evaluation, integration of personality, autonomy, group-oriented attitudes and environmental mastery than female non player subjects, and over all mental health, there is significant difference between female player and female non -player subjects.

Keywords: Mental health, male players, female players

Introduction:

For some time now, it has been common knowledge that exercise is good for one's physical health. It has only been in recent years, however, that it has become commonplace to read in magazines and health newsletters that exercise can also be of value in promoting sound mental health. The World Health Organization defines mental health as "a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (*Stephen et al, 2005)*. Neither mental nor physical health can exist alone. Mental, physical, and social functioning are interdependent. In recent years, there has been evidence of disturbingly high rates of mental ill-health among adolescents and even younger children, ranging from low-self-esteem, anxiety and depression to eating disorders, substance abuse and suicide *(Sallis and Owen, 1999)*. Research suggests two ways in which physical activities can contribute to mental health in adolescents. Firstly, there is fairly consistent evidence that regular activity can have a positive effect upon boys' and girls' psychological well-being. Secondly, research has indicated that physical activity can contribute to the reduction of problematic levels of anxiety and depression. Evidence is beginning to be gathered for exercise as a treatment for clinical depression, with studies finding that physical activity is as effective a treatment as anti-depressants *(Dimeo et al., 2001)*, and psychotherapy *(Martinsen, 1994).* Similarly, a variety of nonclinical

studies have found that higher levels of activity were related to lower rates of depression *(Hassmen et al., 2000).* A position statement of the International Society of Sport Psychology *(Singer, 1992)* drew out numerous mental health benefits of physical activity from the research literature, including reduced state anxiety, neuroticism and anxiety, mild to moderate depression, and various kinds of stress. A review of current literature indicates that people who participate in sports and organized recreational activity enjoy better mental health, are more alert, and more resilient against the stresses of modern living. Participation in recreational groups and socially supported physical activity is shown to reduce stress, anxiety and depression, and reduce symptoms of Alzheimer's disease *(Carcach & Huntley, 2002).*

Hypotheses

1. There exists significant difference in the level of mental health between the male player students and the male non-player students.
2. There exists significant difference in the level of mental health between the female player students and the female non-player students.

Materials & Methods

Selection of the sample

The present study was conducted on 50 Boys and 50 Girls ranging in age from 17-21 years. A total of 100 subjects (player and non player college going students) were selected for the present research study. The sample selection method was used as purposive sampling technique. The area was limited to Chandigarh. The detailed break-up of the sample is given below:

Area	Male (N)	Female (N)	Total (N)
Player	**25**	**25**	**50**
Non-Player	**25**	**25**	**50**
Total	**50**	**50**	**100**

Independent Variables: a) Sex *b)* Type of students.

Dependent Variables: Mental Health.

Selection of research tool: Mental health inventory *(Jagdish and Srivastav, 1983).*

The data was collected from the various colleges and sports training centers. The subjects were first explained about the aim of the research study, thereafter mental health inventory given by *Jagdish and Srivastav (1983)* was administered. The subjects' were assured confidentiality of their responses.

Results & Discussion

Table-1: Table-2: Statistical Comparison of Mental Health Inventory components between male player and non- player students.

Area	Type	N	Mean	S.D.	t-value	Sign.
Positive self evaluation	**Players**	**25**	**33.12**	**3.72**	**2.19**	**0.05**
	Non-Player	**25**	**31.08**	**2.81**		
Perception of reality	**Players**	**25**	**25.88**	**2.86**	**0.72**	**NS**
	Non-Player	**25**	**25.20**	**3.78**		
Integration of personality	**Players**	**25**	**39.32**	**3.66**	**3.50**	**0.01**
	Non-Player	**25**	**35.36**	**4.31**		
Environ mental Mastery	**Players**	**25**	**20.52**	**1.96**	**2.32**	**0.01**
	Non-Player	**25**	**19.32**	**2.44**		
Group oriented attitudes	**Players**	**25**	**34.68**	**4.34**	**0.64**	**NS**
	Non-Player	**25**	**33.96**	**3.55**		
Autonomy	**Players**	**25**	**33.96**	**2.52**	**4.04**	**0.01**
	Non-Player	**25**	**30.68**	**3.17**		
Over all	**Players**	**25**	**187.48**	**7.14**	**5.50**	**0.01**
	Non-Player	**25**	**175.40**	**8.35**		

Table 1 shows difference between the groups of male player and male non – player subjects on the various factors of Mental Health Inventory. Only four factors are showing significant difference between the two groups at the 0.05 and 0.01 levels on 48 df grade. It is concluded that player subjects are found more positive in self-evaluation (t=2.19, p<0.05), integration of personality (t =3.50, p<0.01), autonomy (t=2.32, p<0.01) and environmental mastery (t =4.04, p<0.01), than the non player subjects, and over all mental health, there is significant difference between male player and male non –player subjects. The obtained 't' values of these groups are 5.50. In order to be significant at 0.05, the minimum required value of 't' is 2.02. While at 0.01 level it is 2.70. Since the obtained value is larger than which is required to be significant at 0.01 level.

Table-2: Statistical Comparison of Mental Health Inventory components between female player and non- player students.

Area	Type	N	Mean	S.D.	t-value	Sign.
Positive self evaluation	Players	25	32.24	3.02	3.07	0.01
	Non-Player	25	29.36	3.59		
Perception of reality	Players	25	24.80	3.84	0.59	NS
	Non-Player	25	24.12	4.58		
Integration of personality	Players	25	37.12	5.58	2.06	0.05
	Non-Player	25	33.84	5.64		
Autonomy	Players	25	18.36	2.66	3.19	0.01
	Non-Player	25	16.24	1.98		
Group oriented attitudes	Players	25	35.20	3.85	2.88	0.01
	Non-Player	25	31.84	4.37		
Environmental Mastery	Players	25	33.12	4.02	2.16	0.05
	Non-Player	25	30.84	3.39		
Over all	Players	25	180.04	8.34	4.89	0.01
	Non-Players	25	166.80	10.65		

Table 2 shows difference between the groups of female player and female non -player subjects on the various factors of M. H. Inventory. Five factors out of six are showing significant difference between two groups at the 0.05 and 0.01 level on 48 df grade. It is concluded that player subjects are found more positive self evaluation (t = 3.07, p<0.01), integration of personality (t =2.06, p<0.05), autonomy (t = 3.19), group oriented attitudes (t = 2.88, p<0.01) and environmental mastery (t =2.16, p<0.05) than non player subjects, and over all mental health there is significant difference between female player and female non –player subjects. The obtained 't' value of these groups are 5.32. In order to be significant at 0.05, the minimum required value of 't' is 2.02. While at 0.01 level it is 2.70. Since the obtained value is larger than which is required to be significant at 0.01 level.

Conclusion

Male player subjects are found more positive self-evaluation, integration of personality, autonomy and environmental mastery than male non player's subjects and over all mental health there is significant difference between male player and male non -player subjects.

Female Player subjects are found more positive self-evaluation, integration of personality, autonomy, group-oriented attitudes and environmental mastery than female non player subjects and over all mental health there is significant difference between female player and female non -player subjects.

Discussion

The aim of the present study was to examine mental health dimensions

between player and non- player students. It was hypothesized that there exists significant difference in the level of mental health between the male player students and the male non-player students. It was also hypothesized that there exists significant difference in the level of mental health between the female player students and the female non-player students. Findings of the present study clearly indicated that -Male player subjects are found more positive in self-evaluation, integration of personality, autonomy and environmental mastery than male non player subjects, and in over all mental health there is significant difference between male player and male non -player subjects. These results are also in agreement with the conclusions reached by *Morgan (1984), Humphrey et al (2000)* and *Stephen et al (2005).* Female Player subjects are found more positive in self-evaluation, integration of personality, autonomy, group-oriented attitudes and environmental mastery than female non player subjects, and over all mental health, there is significant difference between female player and female non -player subjects. The results of the present study are partially supported by the findings of *Mckelvie et al. (1981), Bailey and Moulton (1999)* and *Hossein et al. (2011).* The research literature suggests that for many variables there is now ample evidence that a definite relationship exists between exercise and improved mental health. This is particularly evident in the case of a reduction of anxiety and depression. For these topics, there is now considerable evidence derived from over hundreds of studies with thousands of subjects to support the claim that "exercise is related to a relief in symptoms of depression and anxiety." Sports and physical exercise is related not only to a relief in symptoms of depression and anxiety but it also seems to be beneficial in enhancing self-concept, self-efficacy, confidence, feeling of worth-whileness, ability to understand, ability to get along with others, work with others and ability to take responsibilities and capacity for adjustment. None of these relationships is the result of a single study. They are based on most, if not all, of the available research in the English language at the time the meta-analytic review was published. The overall positive patterns of the meta-analytic findings for these variables lends greater confidence that exercise has an important role to play in promoting sound mental health.

References

Bailey, K., Moulton, M., and Moulton, P. 1999. Athletics as a predictor of self-esteem and approval motivation. *The Sports Journal*, **2(2):** 1-5.

Carcach, C. Y., Huntley, C. 2002. Community Participation and Regional Crime. Australian Institute of Criminology. Trends and Issues in Crime and Criminal Justice Number 222. (Canberra: AIC).

Dimeo, F., Bauer, M., Varahram, I., Proest, G. and Halter, U. 2001. Benefits of Aerobic Exercise in Patients Withmajor Depression: a pilot study. *Brit. J. Sports Med.*, **35:** 114-117.

Hassmen, P., Koivula, N. and Uutela, A. 2000. Physical Exercise and Psychological Well-being: a population studyin Finland. *Prev. Medicine*, **30(1):** 17-25.

Taylor, M., Pietrobon, R., Pan, D., Huff, M. and Higgins, L. 2004. Healthy People 2010 Physical Activity Guidelines and Psychological Symptoms: evidence from a large nationwide database. *J. Phys. Activity and Health*, **1:** 114-130.

Hossein, P. Z., Farhad, R., Fatemeh, M. 2011.Comparing the Mental Health of the Athletic and Non- athletic Physically-disabled People. *Iran. J. Health and Physical Activity*, **2(1):** 6-10.

Humphrey, J. H., Yow, D. A. and Bowden, W. W. 2000. Stress in college athletics: Causes,

consequences, coping. Binghamton, NY: The Haworth Half-Court Press.

Jagdish and Srivastava, A. K. 1983. Mental Health Inventory. Varanasi Manavaigyanik Sansthan.

Martinsen, E. 1994. Physical Activity and Depression: clinical experience. Acta Psychiatrica Scandinavica, 377, pp. 23-27.

McKelvie, S. J., Simpson-Housley, P., and Valliant, P. M. 1981. Personality in athletic and non-athletic college groups. *Percep. Motor Skills*, **52(3):** 963-966.

Morgan, W.P. 1984. Selected psychological factors limiting performance: A mental health model. American Academy of Physical Education Papers, 18, 70-80.

Sallis, J. and Owen, N. 1999 Physical Activity and Behavioral Medicine. Thousand Oaks, US: Sage.

Singer, R. 1992. Physical Activity and Psychological Benefits: a position statement of the International Society of Sport Psychology (ISSP). The Sports Psychologist, 6, pp. 199-203.

Stephen, D. E., Humphrey, S. B., Ngcobo, D. J., Edwards and Palavar, K. 2005. Exploring the relationship between physical activity, Psychological well-being and physical self-perception In different exercise groups. South African Journal for Research in Sport, Physical Education and Recreation, **27(1):** 75-90.

World Health Organization 2005. Promoting Mental Health: Concepts, Emerging evidence, Practice: A report of the World Health Organization, Department of Mental Health and Substance Abuse in collaboration with the Victorian Health Promotion Foundation and the University of Melbourne. World Health Organization. Geneva.

Comparative Study of Body Composition between City and Rural Area Boys in Gandhinagar

Vyas, M.R., Thakur, S.J. & Parmar, P.P.
Sadra, District Gandhi Nagar, Gujrat

Abstract

The purpose of this study was to compare the Body Composition of Gandhinagar City and Rural Boys. Thirty boys of Gandhinagar City and thirty boys from rural institutions of Gandhinagar District were selected randomly for the the study. Weight (Kg), Body Mass Index, Fat (%), Fat Mass, Total Body Water was measured by standard techniques as described by *Weiner & Lourie (1969).* The study revealed that the city and rural boys of Gandhi Nagar do not demonstrate significant differences in their body composition.

Keywords: Rural, City, Boys, BMI, Body compostion, Weight, total Body Water

Introduction

Considerable changes are taking place in the India's` children in urban-rural conditions and have greatly impacted the social and biological transformation of populations. The urbanization process, however, occurs under different circumstances among countries *(Valladares and Coelho, 1993).* Living in areas distinguished by population size can be linked with differences in eating habits, right of entry to sport facilities, sanitation and health services and opportunities for physical activities *(Tsimeas et al, 2005).* Urban and rural environmental differences in growth of children have come into spotlight of interest in the last years. There are numerous studies which have reported contradictory evidences in samples from various countries and cutures and with various age ranges. *Bielicki (1986)* and *Eiben et al (2005)* reported that within a specific country or cultural group in Europe, children who were living in urban areas have greater size than children in rural areas, while there were no significant differences in the growth status in children who were living in urban and rural areas in United Stated and Canada *(Malina et al, 1981; Eveleth & Tanner, 1990; Pena Reyes et al, 2003), Lin et al (1992)* reported China's` children in urban-rural conditions. Data from Africa, also, revealed that urban-rural contrasts are evident in the growth and body size *(Cameron et al, 1992; Pawloski, 2002).*

Because the special situation of Gandhi Nagar district of Gujrat State in India, which has many rural populations near to urban areas, the present study was chosen to consider urban-rural differences in body composition in urban-rural communities.

The purpose of this study was to compare the Body Composition & fitness of Gandhinagar City and Rural Boys. Thirty boys of Gandhinagar City and thirty boys from rural institutions of Gandhinagar District were selected randomly for the the study. Weight (Kg), Body Mass Index, Fat (%), Fat Mass, Total Body Water was measured by

standard techniques as described by *Weiner & Lourie (1969).*

To compare the Body Composition Analysis of Gandhinagar City and Gandhinagar Rural Boys "t" test was applied.

Results & Discussion

Table 1 gives the statistical comparison of weight, BMI, fat %, fat mass & TBW of City & Rural boys of Gandhinagar.

Table 1: Statistical comparison of weight, BMI, fat %, fat mass & TBW of City & Rural boys of Gandhinagar

Sr No.	Event	City Boys	Rural Boys	Mean Difference	" T " Ratio
1	Weight, kg	41	40.09	0.91	0.5
2	BMI	16.44	17.15	0.71	0.54
3	Fat %	8.59	11.43	2.84	1.95
4	Fat Mas, kg	3.75	4.81	1.06	1.43
5	TBW	27.3	25.9	1.40	1.47

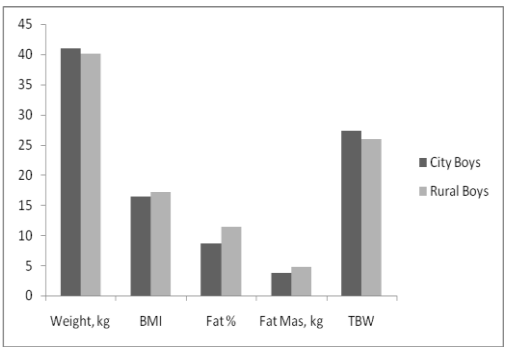

Figure 1: Comparison of weight, BMI, fat %, fat mass & TBW of City & Rural boys of Gandhinagar

On an average, the city boys were found to be heavier than the rural boys but the mean difference in body weight of the Gandhinagar City and Rural area boy was not found to be significant in statistical terms. Body mass index (BMI) reflects the relationship between adult weight and height, and body composition are closely related and to determine body fat, thin, an important indicator of the degree. WHO recommends that adult body mass index (BMI) of the normal range of 18.5-25, less than 18.5 as malnutrition, more than 25 were overweight or obese. The average BMI of the boys belonging to rural and city areas was less than 18 in the present study. In BMI, although the mean values were slightly greater in rural boys as compared to the city boys, but in statistical terms the difference is non significant. In the same manner non significant difference in fat%, fat mass and total body water was observed between the city and rural boys. In general, statistical analysis shows that, there exist non significant differences in body composition between Gandhinagar City and Rural Area School Boys.

Conclusion

The city and rural boys of Gandhi Nagar do not demonstrate significant differences in their body composition.

References

Bielicki, T., 1986. Physical growth as a measure of economic well-being of populations: The twentieth century. In F Falkner and JM Tanner, eds.: Human Growth. A Comprehensive Treatise, Vol 3. Plenum Press,New York. pp: 283-305.

Cameron, N., Kgamphe, J.S., Leschner, K.F. and Farrant, P.J. 1992. Urban-rural differences in the growth of South African black children. Annual of Human Biol., 19: 23-33.

Eiben, O.G., A. Barabás and A. Németh, 2005. Comparison of Growth, Maturation and Physical Fitness of Hungarian Urban and Rural Boys and Girls. J. Hum. Ecol., 17: 93-100.

Eveleth, P.B. and J.M. Tanner, 1990. Worldwide variation in Human Growth. Cambridge University Press, 2nd edition, Cambridge.

Lin, W.S., A.C.C. Chen, J.Z.X. Su, Y.Q. Zhang, F.C. Zhu, W.H. Zing and J.Y. Li, 1992.

Developmental perspective of pulse rate, blood preassure and vital capacity in Chinese children. Annual of human Biol., 19: 387-402.

Malina, R.M., Himes, J.H., Stepick, C.D., Lopez, F.G. and P.H. Buschang, 1981. Growth of rural and urban children in the valley of Oaxaca, Mexico. American J. Physical Anthropol., 54: 327-336.

Pawloski, L.R., 2002. Growth and development of adolescent girls from the Segou region of Mali (West Africa). American J. Physical Anthropol., 117: 364-372.

Pena Reyes, , M.E., Tan, W.K.and Malina, R.M. 2003. Urban-rural contrasts in the physical fitness of school children in Oexaca, Mexico. American J. Human Biol., 15: 800-813.

Tsimeas, P.D., A.L. Tsiokanos, Y. Koutedakis, N. Tsigilis and S. Kellis, 2005. Does living in urban or rural settings affect aspects of physical fitness in children? An Allometric approach. British J. Sport and Med., 39: 671-674.

Valladares, I. and M. Coelho, 1993. Urban research in Latin America: toward a research Disscussion paper series No. 4 (http://www. unesco. agenda. org/ most/valleng.htm).

Effect of Moderate Intensity of Aerobic Exercise Programme on Exercise Tolerance Capacity of Stable Angina Patients

Mazumdar, S., Verma, S. K. and Kumar, A.
Prof. Babab Farid University of Health Sciences, Faridkot, Punjab, Email: mazumdars20@yahoo.com
Prof. (Retd), Department Sports Sciences, Punjabi University, Patiala-147002, Punjab
Asst. Prof., Department Sports Sciences, Punjabi University, Patiala-147002, Punjab

Abstract

The purpose of this study was to observe the effect of moderate intensity of aerobic exercise programme on exercise tolerance capacity of stable angina patients. Sixty male patients of stable angina were recruited as subjects and their age ranged from 40-60 years, further they were divided equally into experimental group and control group. Experimental group underwent a six weeks moderate intensity aerobic exercise programme while the control group was lead a routine sedentary life style for six weeks. Exercise tolerance capacity was measured by using Borg's scale in both the groups on the first day and after every 2 weeks. It was found that at the end of six weeks of aerobic programme there was an increase in the exercise tolerance capacity of the stable angina patients of the experimental group than control group. It is concluded that six weeks moderate intensity aerobic exercise programme of cardiac rehabilitation for the patients of stable angina is a short time period for peripheral adaptation than the central adaptations.

Key words: Cardiac rehabilitation, Borg's Scale, THR, RHR

Introduction

Stable angina is defined as a short duration chest and/or arm discomfort that shows no change in the past 60 days in frequency, duration or precipitating cause. Most often pain duration is less than 10 minutes and rarely up to 15 minutes. The mild to moderate discomfort is relieved within 1 to 10 minutes by cessation of the particular precipitating activity or use of sublingual nitroglycerine *(Khan, 2006).* Most patients with stable angina will be at increased risk of subsequent cardiovascular events or death, the assessment of a patient's absolute risk of subsequent cardiovascular events or death should be based on assessment of all of his risk factors as well as modifiable risk factors include age, sex, presence of diabetes, and family history of premature coronary heart disease. Exercise training is an effective method of reducing episodes of angina in people with stable angina. Chronic low intensity aerobic exercise trains the cardiovascular system and the skeletal muscles to become more efficient which means that one can exercise at higher levels of intensity without experiencing angina. A program of aerobic exercise has many benefits in addition to reducing episodes of angina. The physiological changes both in exercising skeletal muscle and the myocardium play a role in the symptomatic improvements and increased maximal work capacities in individual with coronary artery disease after regular aerobic exercise *(May and Nagle, 1984).*

Materials and Method

A sample of 60 male patients of stable angina between the age group 40-60 years were randomly divided into the experimental group and the control group of 30 patients in each group. The experimental group was prescribed cardiac rehabilitation in the form of

aerobic exercises for 30 minutes, 4 times a week for 6-weeks. The control group was not prescribed any cardiac rehabilitation and was advised to live their normal sedentary life. The experimental group was administered exercise at an intensity calculated by Karvonen's formulae:-

For the first two weeks

$$\dot{THR} = \dot{RHR} + 31\% (\dot{HR}_{max} - \dot{THR}).$$

Next two weeks

$$\dot{THR} = \dot{RHR} + 35\% (\dot{HR}_{max} - \dot{THR}).$$

Last two weeks

$$\dot{THR} = \dot{RHR} + 40\% (\dot{HR}_{max} - \dot{RHR}).$$

$\dot{RHR}$ Stands for resting Minute heart rate

$\dot{THR}$ Stands for Target Minute Heart Rate

$\dot{HR}_{max}$ is the Maximal Minute heart rate

The exercise tolerance was measured by Borg's Scale (6-20 scale) after every 2 weeks at the time of exercise for the experimental group and at leisure time for the control group. Data was computed for paired student's test after every 2 weeks in the same group to observe the effectiveness of cardiac rehabilitation.

Results and Discussion

Table 1: Mean ± SD of Scores of Borg's scale of the experimental and control group

Group	Stage	N	Mean	SD	SEM
Experimental	B	30	14.48	0.82	0.15
	2w	30	15.67	0.88	0.16
	4w	30	16.53	0.63	0.11
	6w	30	14.13	0.9	0.16
Control	B	30	14.4	0.62	0.11
	2w	30	13.9	0.89	0.16
	4w	30	13.67	0.61	0.11
	6w	30	13.33	0.71	0.13

B-before the start of rehabilition, 2w- after two weeks, 4w- after four weeks, 6w- after six weeks,

Table 1 shows the mean values of the scores of Borg's scale of the subjects of two groups. The score on the Borg's scale expressed the perceived exertion of the patients during exercise. The 15-Grade Borg's scale read the scores from 6-20 as the rate of perceived exertion. The score of 13 on the Borg's scale indicated somewhat hard intensity of exercise and 15 referred to heavy exercise intensity. After the cardiac rehabilitation of 6-weeks, the mean scores (Table 1) on the Borg's scale showed changes with the increase in the intensity of exercises advised. Paired t- test (Table 2) was applied to observe the differences between every two consecutive week intervals.

Table 2: Comparison of Scores of Borg's Scale between Experimental and Control group before and after at every consecutive 2 weeks

Group	Stage	N	Mean Difference	SD	SEM	t
Experimental	B-2w	30	-1.2	0.55	0.1	11.93
	2w-4w	30	-0.87	0.63	0.11	7.55
	4w-6w	30	2.4	0.85	0.16	15.37
	B-6w	30	0.35	0.86	0.15	2.33
Control	B-2w	30	0.37	0.81	0.15	2.48
	2w-4w	30	0.37	0.56	0.1	3.61
	4w-6w	30	0.33	0.57	0.14	3.34
	B-6w	30	1.07	0.92	0.17	6.29

Significant at 0.05 level

The experimental group showed a trend of rising intolerance at the end of 2nd week and at the end of the 4th week, but mean scores indicate that there was an improvement in the exercise tolerance at end of the 6th week. On the other hand, the

control group showed a gradual decrease in the exercise intolerance (Table 1). The experimental group showed a significant difference at every successive 2 week interval (Table 2). On the other hand, the control group also slowly gained the comparative exercise tolerance to demonstrate a significant difference between the initial patients exercise tolerance after a sedentary lifestyle of 6 weeks. The rest at home and reduction of the psychological stress may be the reason for perceiving less exertion in the initial 4 weeks in the control group but perceived exertion experimental group on the Borg's scale the at the end of 6^{th} week was although greater than the mean of the control group but still comparabe. Lack of development of aerobic capacity and cardiovascular fitness in the control group might have lead to low physical work capacity in them even for doing activities of their daily living.

The reduced exercise capacity has been related to the de-conditioned state of the muscle and the reduced aerobic capacity of the subjects. *Minotti and Massie (1992)* are of the view that the de-conditioning of peripheral musculature due to inactivity may play a role in exercise tolerance, there is a difference noted at cellular level between muscle cells of de-conditioned healthy subjects and those of patients with chronic heart disease. Recent studies have revealed intrinsic changes in skeletal muscle fibers which may be responsible for impaired metabolism and result in early fatigue. These changes include reduced mitochondrial density, reduction in lipolytic oxidative enzymes and fiber atrophy *(Coats, 1993)*. The fact lies in that exercise training for the experimental groups improved the functional capacity and reduced the myocardial ischemia and angina symptoms in patients with stable coronary heart disease *(Leon et al, 2005)*. Endothelial dysfunction is known to be the precursor of atherosclerosis (*Davignon & Ganj, 2003)* and *Nigam et al (2004)*. The effects of exercises has been shown to improve endothelial function by increasing shear stress-induced flow mediated arterial vasodilatation *(Walter et al, 2004, and Haram et al, 2006)* and this increased shear stress on the arterial wall during exercise leads to increased production and release of nitric oxide from the endothelial cells *(Shen et al, 1995)*; nitric oxide is responsible for endothelium dependent vasodilatation of the coronary arteries *(Ignarro, 1989)*. This vasoactive substance has numerous antiatherosclerotic antithrombotic effects *(Freedman & Loscalzo, 2003)*.

Conclusion

It was found that at the end of six weeks aerobic programme there was an increase in the exercise tolerance capacity of the stable angina patients of the experimental group as compared to the control group. It is concluded that six weeks moderate intensity aerobic exercise programme of cardiac rehabilitation for the patients of stable angina is a short time period for peripheral adaptation than the central adaptations.

References

Coats A.J.S. 1993. Exercise rehabilitation in chronic heart failure. *Journal of American College of Cardiology.* **22(4):** 172A-177A.

Davignon, J. and Ganz, P. 2003. Role of endothelial dysfunction in coronary heart disease. Am. J. Cardiol., 92: 395-399.

Freedman, J.E. and Loscalzo, J. 2003. Nitric oxide and its relationship to thrombotic

disorders. *J. Thromb. Haeost.*, **1:** 1183-1188.

Haram, P.M., Adams, V., Kemi, O.I., et al. 2006. Time–course of endothelial adaptation following acute and regular exercise. Eur *J. Cardiovasc. Prev. Rehab.*, **13:** 585-591.

Ignarro, L.J. 1989. Endothelial-derived nitric oxide: actions and properties. *FASEB J.* **3:** 31-36.

Khan, G.M. 2006. Contemporary Cardiology: Heart disease Diagnosis and Therapy: A Practical Approach. Second edition; Humana press Inc. Totowa, NJ.136-138, 148.

Leon, A.S., Franklin, B.A., Costa, F. et al. 2005. For the American Heart Association; Council on Clinical Cardiology (Subcommittee on Exercise, Cardiac Rehabilitation and Prevention); Council on Nutrition, Physical Activity and Metabolism (Subcommittee on Physical Activity); American association of Cardiovascular and Pulmonary Rehabilitation. Cardiac rehabilitation and secondary prevention of coronary heart disease : an American Heart Association scientific statement from Council on Clinical Cardiology (Subcommittee on Exercise, Cardiac Rehabilitation and Prevention) and the Council on Nutrition, Physical Activity and Metabolism (Subcommittee on Physical Activity) in collaboration with the American association of cardiovascular and Pulmonary Rehabilitation. *Circulation.* **111:** 369-376.

May, G.A.and Nagle, F.J. 1984. Changes in rate pressure product with physical training of individuals with coronary artery disease. *Phys. Ther*., **64(9):** 1361-1366.

Minotti J.R. and Massie B.M. 1992. Exercise training in heart failure patients: Does reversing the peripheral abnormalities protect the heart? Circulation. **85(6):** 2323-2325.

Nigam, A., Mitchell, G.F., Lambert, J. and Tardif, J.C. 2004. Relation between conduit vessel stiffness (assessed by tonometry) and endothelial function (assessed by flow–mediated dilatation) in patients with and without atherosclerosis. *Circulation*, **109 (suppl 1):** 11127-11132.

Shen, W., Zhang, X., Zhao, G., Wolin, M.S., Sessa, W. and Hintze, T.H. 1995.Nitric oxide production and NO synthase gene expression contribute to vascular regulation during exercise. *Med. Sci. Sports. Exerc.*, **27:** 1125-1134.

Walter, C., Gielen, S., Hembrecht, R. 2004. The effect of exercise training on endothelial function in cardiovascular disease in humans. *Exerc. Sports Sci. Rev.*, **32:** 129-134.

Developmental disturbance of permanent teeth following trauma to primary dentition in young athletic children

Verma, L., Asst. Prof., Dr Harvansh Singh Judge Institute of Dental Sciences, Panjab University, Chandigarh

Abstract

Orofacial trauma is a serious orodental and general health problem that may have medical, esthetic and psychological consequences for young atheletic 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 crown of the unerupted permanent tooth. this study presents a case report in which injury to the primary dentition resulted in morphological changes in the germ of the permanent sucessor. The permanent incisor erupted with an enamel hypoplasia and was treated with light –cured composite resin restoraration. This procedure re-established the function, the esthetic appearance and self esteem of the patient.

Keywords: Enamel hypoplasia, Dental trauma

Introduction

Orofacial trauma is a serious orodental and general health problem that may have medical, esthetic and psychological consequences for young atheletic children and their parents. 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 *(Autun et al, 2009)*. An intrusive injury occurs when the impact of an axial force displaces the tooth within the socket. 18% to 69% of intrusive injuries to the primary dentition are caused by the anomalous development of the permanent teeth *(Flores, 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. Of these enamel hypoplasia and dilacerations are the most common sequale *(Andreasen & Andreasen, 1994; Andrade et al, 2007).*

The present study relates a clinical case of an aesthetic treatment in permanent teeth with localized crown malformation, enamel hypoplasia/dilacerationas as a result of traumatic injury in the primary lower central incisor.

Case Report

A 12 year old young atheletic basketball player reported to the O.P.D Clinics of Dr Harvansh Singh Judge Institute of Dental Sciences, Panjab University Chandigarh with a chief complaint of unesthetic lower anterior teeth which were altered in shape and color. Following clinical examination a diagnosis was made of enamel hypoplasia in lower left central incisor which presented with yellowish brown discoloration and crown dilaceration in the incisal one third (Figure 1). His medical history revealed that at 44 months

of age he had injured his primary mandibular central incisor while playing in the ground.

Figure 1: Intraoral view shows crown malformation and enamel hypoplasia of the permanent mandibular left central incisor

The planning treatment was aesthetic restorations with composite resin. After isolation, the teeth were cleaned and acid etching was done with 37% phosphoric acid on the affected surface of enamel near the lesion. After 20 sec the etchant was washed with water and dried .Then bonding agent was applied with a brush and cured for 10 sec. In sequence composite was applied in increments and each layer was cured for 30 sec. The composite was inserted in increments in the angles and in the proximal surfaces for the reconstruction of the crown dilaceration. The finishing was made with composite polishing burs (Figure 2).

Figure 2: Intraoral view after restoration of the permanent mandibular left central incisor with a light-cured composite resin.

Discussion

Developmental disturbances of the permanent teeth involving crown have been reported to occur more frequently than those involving the roots and eruption patterns. This finding may be attributed to the close relationship between the primary tooth root and the permanent tooth crown and the fact that the majority of the traumatic injuries occur during 1 and 4 years, during the developmental stage of permanent crownIn the present case ,shape and color alterations were observed in the crown only and the trauma occurred when the child was 4 years old, in which the germ of the permanent successor was in the process of odontogenesis .Probably the trauma promoted ameloblasts destruction in the active enamel epithelium and caused crown dilacerations and enamel hypoplasia *(Von Arx, 1993)*. Causes of primary anterior tooth trauma are falls when infants are in the stage of insufficient motor controls, sports and other traffic accidents.

Depending on the degree of severity of these anomalies, various protocols of treatments may be practiced including whitening, microabrasion, aesthetic conservative restorations, and prosthetic rehabilation.

In the present case, restoration of the incisal and middle one third of central incisor was necessary. The composite restoration was done for reconstruction of crown dilacration.

Conclusions

The case report here stresses the importance of traumatic injuries to primary dentition because of their effect

on permanent tooth germ. Injured teeth should be followed up periodically for possible periapical infection and pulp necrosis. In addition special care may be necessary in the restoration of the injured teeth because their reaction pattern may be different from those of non traumatised teeth.

References

Autun, C., Esenlik, E., Tozum, T.F. 2009. Hypoplasia of a permanent incisor produced by primary incisor intrusion: a case report JCDA; 75: 215-8

Flores, M.T. 2002. Traumatic injuries in primary dentition. *Dental Traumatology*, **18:** 287-98

Andrade, M.G., Weissman, R., Oleivera, M.G., Heitz, C. 2007. Tooth displacement and root dilaceration after trauma to primary predecessor: An evaluation by computed tomography. *Dental Traumatology*, **23:** 364-367.

Andreasen, J.O., Andreasson, F.M. 1994. Textbook and color atlas of traumatic Injuries to the teeth 3rd edition; Copenhagen: Mosby.

Von Arx, T. 1993. Developmental disturbances of permanent teeth following Trauma to primary dentition *Australian Dental Journal*, **38:** 1-10.

Instructions to Contributors

Journal of Exercise Science and Physiotherapy (JESP) is a scientific peer reviewed journal, publishing research studies and review articles in the field of sports injuries, physiotherapy, exercise physiology, sports rehabilitation, diseases and exercise, sports psychology, nutrition, physical education, sports biomechanics, kinesiology and sports education.

JESP is published annually in June but is planned to be published biannually in the near future. Articles written in English should be sent to the editor of JESP. The research paper for publication in the journal could be sent not only in typed manuscript form but also through the Internet using email attachment. Keeping in view the postal delays, authors, therefore, are encouraged to submit their research material/articles as email directly to ***satishsk1@rediffmail.com***

Mission

JESP aims to present easy access to the scientific knowledge for health & sport conscious individuals. The purpose is to minimise the problems like the delays in publishing process of the articles by drawing advantage from electronic medium.

Instructions to Authors

The articles may be submitted to the Editor, JESP (*email: satishsk1@rediffmail.com*). Manuscripts are considered if they are submitted only to JESP and therefore should not be under consideration for publication elsewhere, either in part or in whole. Authors are responsible for the scientific context and legal aspects of the articles. Editors may make necessary changes to articles in accordance with "Instructions to Authors". Normally the complete research paper should not exceed 15 typed pages including tables and figures; however under exceptional circumstances this limit can be relaxed. There is no page and reference limitation for the review articles. All files related to manuscripts should be submitted electronically. Internet transmission and e-mail attachments are preferred; CD-ROM is acceptable for large files. Text files should be in Microsoft Word 6.O and later versions. Each figure, table, photograph or other image should be submitted electronically. The manuscripts should be submitted in Times New Roman font, 12-point type, double-spaced with 3 cm margins on all sides. The reference style used by the Journal is the Harvard System of referencing.

Format for Research Article

Include the following sections in research articles without page space:

Title: Capital letters.

Authors: Surname followed by initials and institution(s) where the study was conducted.

Abstract Include an abstract of not more than 150 words that includes objectives, methods, results and conclusions.

KEY WORDS*:* To assist in indexing the journal, list up to 6 key words (not from title), which your article could be indexed.

INTRODUCTION

METHODS

RESULTS

DISCUSSION

CONCLUSION

ACKNOWLEDGMENTS: Provide information sufficient to identify sources of support, technical assistance, and intellectual contributions not associated with authorship.

REFERENCES: Each citation in the text must be noted by surname and year in parentheses and must appear in the reference section as an alphabetic order. Example for citation in the text; a) for single author (Gür, 1999), b) for two authors (Gür and Akova, 2001), c) more than two authors (Gür et al., 2000).

Journal Article:

Akova, B., Sürmen-Gür, E., Gür, H., Dirican, M., Sarandöl, E. and Kücükoglu, S. 2001. Exercise-induced oxidative stress and muscular performance in healthy women: role of vitamin E supplementation and endogenous estradiol. *European Journal of Applied Physiology*, **84:** 141-147.

Journal Article, Article not in English:

Seker-Aygül, Z., Akova, B. and Gür, H. 2001. The relationship of stress and stress management factors with injury in soccer players. *Turkish Journal of Sports Medicine*, **36:** 71-80. (In Turkish: English abstract).

Journal Article in press:

Gür, H., Cakin, N., Akova, B., Okay, E. and Kücükoglu, S 2002. Concentric versus combined concentric- eccentric isokinetic training: Effects on functional capacity and symptoms in patients with osteoarthrosis of the knee. *Archives of Physical Medicine and Rehabilitation*, in press.

Journal Article in electronic format:

Weigand, D.A., Carr, S., Petherick, C. and Taylor, A. 2001. Motivational climate in Sport and Physical Education: The role of significant others. *European Journal of Sports Science (serial online)* **1(4)**, (13 screens/inclusive page), October. Available from URL: http://www.humankinetics.com/ejss

Book:

Guyton, A.C. and Hall, J.E. 1996. *Textbook of medical physiology*. 9th edition. W. B. Saunders Company, London.

Chapter in edited book:

Wilson, C.H. 1984. Exercise for arthritis. In: *Therapeutic exercise*. Ed: Basmajian, J.V. 4th edition. Baltimore: Williams and Wilkins. 529-545.

Thesis:

Özyener, F. 2000. *Effects of work intensity on dynamics of pulmonary gas exchange during exercise in humans*. Doctoral thesis, University of London, London. 79.

Thesis not in English:

Özer, Ö. 2001. *The effect of muscle exercise to oxygen kinetics in chronic smoker*s. Doctoral thesis, University of Uludag, Bursa. 1-54. (In Turkish: English abstract).

LEGENDS

AUTHOR BIOGRAPHY: Please include a brief biography, approximately 50 words per author, for each author including (1) academic title/degrees, (2) institution affiliation, (3) research focus, (4) post and e-mail addresses.

TABLES, FIGURES, etc.: The location within the article where e.g. figures and tables appear should be indicated in the text. These materials (e.g. table, figure) should be submitted separately from the text document. Each item should be produced in Microsoft Office (Word, Excel, or PowerPoint), GIF or JPEG format. Submit each item separately and number sequentially as (main author) Figure 1.jpg, (main author) Figure2.jpg, and so on, for example, GurFigure1.jpg and GurTable1.doc.

FORMAT FOR REVIEW ARTICLE

Include the following sections in research articles without page space:

TITLE: Capital letters.

AUTHORS: Surname followed by initials and institution(s) where the study was conducted.

ABSTRACT Include an abstract of not more than 300 words.

KEY WORDS: To assist in indexing the journal, list up to 6 key words (not from title), which your article could be indexed

MAIN TEXT

CONCLUSION

ACKNOWLEDGMENT

REFERENCES*:* Each citation in the text must be noted by surname and year in parentheses and must appear in the reference section as an alphabetic order. Example for citation in the text; a) for single author (Gür, 1999), b) for two authors (Gür and Akova, 2001), c) more than two authors (Gür et al., 2000). See the reference section of research article for detail.

LEGENDS

AUTHOR BIOGRAPHY: For detail see the author biography section of research article.

TABLES, FIGURES, etc.: For details see the tables, figures, section of research article.

REVIEW AND PUBLISHING POLICY

Upon receipt of a manuscript the editor will notify the main author that the submission has been received. The manuscript will undergo a blinded review process. Under this process the editor will forward (electronically) the manuscript to two independent reviewers. Normally the review process will take approximately 4 weeks. After the review process has been completed the main author will be notified via E-mail either of acceptance, revision or rejection of the manuscript. If the main author has not been informed of the results of the review process after 8 weeks from the date of confirmation of receipt of the manuscript (by the editor), the author should notify the editor-in-chief directly. If revision was recommended, this should be completed and returned to the editor within 4 weeks; failure to return the revised manuscript within the allotted time span will lead to rejection of the manuscript. When a manuscript has been accepted for publication it will be forwarded to the editor-in-chief for final approval. The editor-in-chief will work with the main author to make necessary revisions in order for the manuscript to appear in the Journal of Exercise Science and Physiotherapy. The final proof of the manuscript will be sent to the main author as an E-mail attachment. If the main author requires any minor changes to the finished work, these should be submitted electronically to the editor-in-chief within one week. Manuscript accepted in the first half of the year will be published not later than the second half of the year.

The author will be charged Rs. 1500/- for the paper upto 4 printed pages in the journal, if the paper exceeds 4 pages in the journal, he will have to pay Rs. 300/- per exceeding page.

Checklist for Authors

- Double-space manuscript text and use 3cm margins on all sides, and Times New Roman, 12-point type, English and SI units.
- Include with text a title, abstract, key words, figure and table lists, figure and table legends.
- Submit all materials electronically.
- Include complete author names, addresses, e-mail, phone and fax numbers.
- Include a short (~50 words) author biography for each author.

Editor-in-Chief,
JESP