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Analyzing somatosensory changes in community dwelling elderly individuals and determining immediate effects of nerve slider technique on somatosensory components

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Abstract
Aim and objective: The aim of the present study was to analyze effects of neural mobilization on somatosensory changes in community dwelling elderly individuals.
Methodology: Sample of convenience of 80 subjects were taken from community of jolly grant, Doiwala Bhaniyawala and Thano in which two groups were assessed by using cumulative sensory impairment scale. First group was experimental group with 40 subjects of age 60 year- 80 year who were community dwelling elderly subjects, and other group was control group with 40 subjects of age 20-40 year. After assessment nerve slider technique was given to the experimental group subjects, pre and post data were taken using cumulative sensory impairment scale as outcome assessment scale, also comparative analysis was done between control and experimental group.
Result: Significant changes were found on cumulative sensory impairment scale when both groups were compared. Vibration component was maximally affected with ageing followed by pressure, Proprioception and graphesthesia score respectively. Nerve slider technique was found to be beneficial in improving the scores of pressure, vibration, Proprioception and graphesthesia when assessed pre and post therapeutic treatment on cumulative sensory impairment scale.
Discussion: Nerve slider technique is a manual method of stretching the nerve by applying force to nerve structures through postures and multi-joint movements aiming to produce a sliding movement of neural structure relative to their adjacent tissues.
The improvement in the somatosensory component scores may be suggested due to increase in axonal transport of neural structures and improving the sliding of neural structures from its mechanical interface.
Conclusion: The study concluded that significant alteration do occur in pressure, vibration, Proprioception and graphesthesia sensation was present between community dwelling elderly individuals and younger age people. It also signifies alteration was present among pre and post value of somatosensory component which reflects the beneficial effects of nerve slider technique on somatosensory component.

Keywords: Somatosensory, cumulative, neurologically asymptomatic, neural mobilization, community dwelling elderly

Introduction
Peripheral neurologic deficits are commonly found during physical examination of older patients. There are changes in the structure and function of peripheral nerves that may be the result of the aging process itself. Common causes of peripheral neuropathy include diabetes mellitus, alcoholic [1] and nutritional deficiencies (eg, thiamine, B12), infections (eg, HIV, Lyme disease), malignancies**.** Idiopathic or age-related sensory neuropathy has received less attention than it deserves because it often seems to be asymptomatic. From several researches, it is found that there is link between sensory neuropathy and impaired balance with advancing age 1. It is found that with ageing there is loss of different sensations which ultimately leads to impaired balance and gait. Gait disorders were detected in approximately 25 percent of persons 70 to 74 years of age, and nearly 60 percent of those 80 to 84 years of age.

Community dwelling elderly individuals are group of people aged 65 years and above it, who are self-independent old age peoples in community.

It is found that there is high risk of falls among community dwelling elderly individuals due to age related sensory loss affecting proprioception, vibration, graphesthesia, pressure [2].

The cumulative impairment scale is a valid scale for clinically test of pressure, graphesthesia, vibration, Proprioception. So utilizing this to clinically screen the community dwelling elderly individuals who might be at higher risk for developing loss of somatosensory functions and disturbed balance and gait at later stages [3].

Neural mobilization therapy which includes nerve slider technique is found to improve sensory changes in medical conditions like diabetes mellitus, carpel tunnel syndromes and radiculopathies.

Therefore this study aims at analyzing effects of neural mobilization on somatosensory changes in community dwelling elderly individuals [4].

Procedure

In the first part of study samples of convenience of 40 community dwelling elderly subject was selected on the basis of inclusion and exclusion criteria.

After the collection of demographic data, the subjects were tested for following sensory components

1. Pressure
2. Vibration
3. Proprioception
4. Graphesthesia

1. Pressure

The subjects assumed a supine position with their eyes close. Pressure sensitivity was tested using 4.31 and 4.56 Semmes Weinstein monofilament applied to the skin of lateral malleolus. The 4.31 Semmes Weinstein monofilament provides the 2.04gm of force and 4.56 Semmes Weinstein monofilament provide the 3.63gm of force. Each filament was applied twice, and the sensitivity of that filament was considered absent if it doesn't not sense on at least one trial. Pressure sensitivity was recorded as follows: 0, normal (both filaments sensed): 1, reduced (only 4.56 filament sensed): 2, absent (neither filament sensed).

2. Vibration

The vibratory stimulus was created with a 128-Hz diapason on the bony prominence of the first metatarsal bone. The participants were asked to report if they perceived the vibration. If the vibration get perceived, they were asked to indicate when they no longer perceived the vibration. Vibration sensitivity was graded as follows: 0, normal (≥10s); 1, reduced (1–9s); and 2, absent.

3. Proprioception

Proprioception was tested at ankle joint. The Participants were in supine position. The tester positioned the reference ankle 10° dorsiflexion from the neutral position with goniometer. Now the participant was asked to place test ankle as same as reference ankle and it was measured with goniometer to see it was equivalent as the reference ankle and 20 planter flexion. From the neutral position, the subject was asked to place the test ankle in the same position to see any variation from the reference ankle. The Proprioception was considered absent if both position error of the tested ankle will be greater than 5° of the reference ankle. It will be considered reduced if this error occurred only for 1 of the 2 positions. Proprioception will be rated as follows: 0, normal; 1, reduced; and 2, absent.

4. Graphesthesia

It can be checked by asking the patients to close the eyes and letters and numerals are traced out on the palm of the hand or the anterior aspect of the forearm, thigh or leg. Clear figures such as 8, 4 or 5 should be used first and if correct, the more difficult 6, 9, 3 can be used obtained data was compared with a control group of 40 samples of age (20-40years) to determine the significant changes with ageing. Then the subjects with reduced and absent sensory components were selected for next part of study where nerve sliding therapy was provided.

The intervention consisted of one of the following two techniques on the first side lower limb and the next on the other side lower limb of the same subject. Thus subjects acted as their own controls with control side receiving the sham treatment and experimental side receiving nerve slider technique.

Experimental intervention

It consist of nerve sliders performed for the positive tested nerve on neurodynamic testing using cumulative sensory impairment scale assessment in which neural mobilizations technique was applied for sciatic, peroneal and tibial nerve for duration of 5 minute with 1 minute pause in between (12 – 15 reps each minute) for each nerve[30].

Control side intervention

The sham intervention consisted of mid-range rhythmic passive joint movements performed by a physiotherapist at, each movement for 5 repetitions, at ankle, subtalar, midfoot, forefoot and toes. The control intervention hence was chosen with an intention to maximally influence tissues other than the nervous system like nociceptive structures. Pretreatment and immediate post treatment data was assessed

Data analysis

Data analysis was done by using statistical process SPSS 20 software. Chi square test/fisher Edward was used to test the proportion distribution between the groups.

McNemar test was used to compare change from pre to post in categorical data, where p less than 0.05 is considered significant.

Results

Cumulative somatosensory scoring was done for pressure, vibration, Proprioception and graphesthesia score in both groups i.e. group 1- experimental group and group 2- control group.

In the first part of the study pre values of somatosensory components among both groups were compared while in second part of study pre and post values of somatosensory components were compared in group 1 i.e. experimental group.

40 subjects were taken among both group and following results were obtained after data analysis when pre score of all four somatosensory sensations were compared between both groups.

For pressure score in group 1 there were 14 subjects with normal pressure score and 26 had impaired pressure score while in group 2, twenty eight subjects had normal pressure score while twelve had impaired pressure score. P value obtained is 0.002 which shows significant change in score of pressure due to ageing.

In case of vibration score in group one only 7 subjects had normal vibration score while 33 had impaired vibration score whereas in group 2, twenty four subjects had normal vibration score and sixteen had impaired vibration score. P value obtained 0.000 showing significant changes in vibration score between groups.

		Group 1	Group 2	Chi square	P value
vibration	Normal	7	24	15.22	0.000
	Impaired	33	16		

		Group 1	Group 2	Chi Square	P value
Pressure (pre)	Normal	14(35)	28(70)	9.82	0.002
	Impaired	26(61)	12(30)		

For Proprioception in group 1, twenty two had normal score and eighteen had impaired score but in group 2, thirty seven had normal Proprioception score while three had impaired Proprioception score. p value obtained was 0.000 which shows significant change in Proprioception score in both groups.

		Group 1	Group 2	Chi Square	P value
Proprioception (pre)	Normal	22(55.00)	37(92.50)	14.52	0.000
	Impaired	18(45.00)	3(7.50)		

For graphesthesia in group 1, thirty two had normal scores and eight had impaired scores while in group 2, none had impaired graphesthesia scoring. p value obtained is 0.003 which represents significant changes in the score of graphesthesia among both groups.

		Group 1	Group 2	Chi Square	P value
Graphesthesia (pre)	Normal	32(80.00)	40(100.00)	8.88	0.003
	Impaired	8(20.00)	0(0.00)		

When sum total of all scores for somatosensory sensation was done then in group 1, there were no subject with normal sensory component, twelve subjects had impaired sensory component, sixteen had delayed and twelve had absent sensory component.

In group 2 there were no subject with absent sensory component, thirteen had normal sensory component, twenty three had impaired and four had delayed sensory component.

In second part of the study pre and post score of somatosensory components were compared in experimental group. Following tables represent the pre and post data for pressure, vibration, Proprioception and graphesthesia scores. McNemar test was applied to determine the change of proportion between pre and post values. P value for pressure score was 0.0002 which shows significant changes from pre to post value similarly p value for vibration, Proprioception and graphesthesia are 0.000, 0.005, and 0.083 respectively. P value obtained for total scoring was 0.000 which represent significant changes from pre value to post value after session of neural mobilizations.

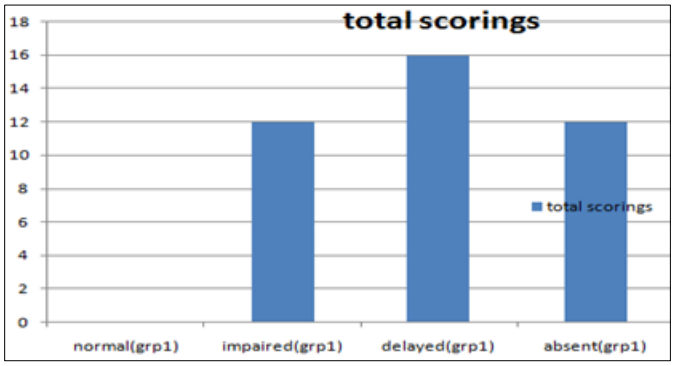

Fig 1: Graphical representations for group 1 total scorings are shown below.

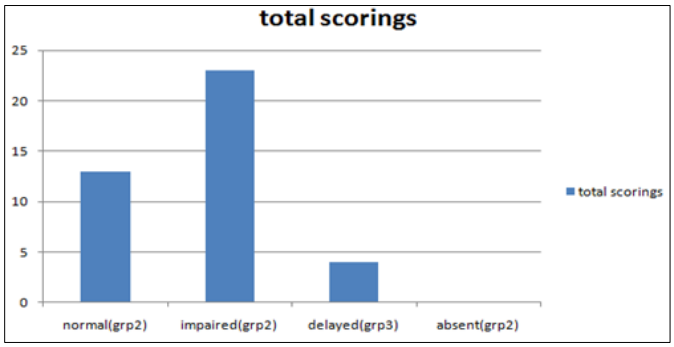

Fig 2: Graphical representations for group 2 total scorings are shown

Discussion

This study analyzed and compared cumulative somatosensory impairment in community dwelling elderly subjects and younger age group subjects.

When data was compared between community dwelling elderly people and younger subjects then it found that most altered somatosensory component was vibration followed by pressure then Proprioception and then graphesthesia least affected.

Somatosensory loss in community dwelling elderly individuals leads to development of balance and gait disorders.

Early somatosensory dysfunction screening can help people in rehabilitation to prevent a major disability in future.

When data was compared between pre and post neural mobilization therapy then p value for all somatosensory component shows significant changes from pre to post somatosensory component values reflecting major role of neural mobilization (nerve slider technique) on somatosensory components.

Nerve slider technique is a manual method of stretching the nerve by applying force to nerve structures through postures and multi-joint movements aiming to produce a sliding movement of neural structure relative to their adjacent tissues.

The improvement in the somatosensory component scores may be suggested due to increase in axonal transport of

neural structures and improving the sliding of neural structures from its mechanical interface.

With increase in age there is preferential loss of distal myelinated sensory fibers, axonal atrophy, declined nerve conduction velocity, neuromuscular performance and receptors impairment of lower extremity pressure, vibration, Proprioception and graphesthesia.

Nerve slider technique when used for sciatic nerve, peroneal nerve and tibial nerve in community dwelling elderly subjects leads to improvement in somatosensory component immediately after application of neural mobilization.

Possible explanation for the improvement after neurodynamic stretching is related to decrease in neuropath mechanics that develop in the nervous system as a result of ageing which is believed to increase neural tissue Mechanosensitivity. Neurodynamic stretching is said to cause deflection of the nerves and decrease in the mechanosensitivity of the neural tissues that results improvement of somatosensory component. Neural mobilization improves neurodynamic maintaining a dynamic balance between neural tissues and surrounding mechanical interfaces and thus inhibiting the mechanosensitivity.

Clinical implications

Nerve slider technique has shown the beneficial effects on improving the somatosensory component in community dwelling elderly individuals. It can help clinicians in early rehabilitation of community dwelling elderly individuals for improved balance and gait and will reduce the frequent falls and risk of fractures among community dwelling elderly individuals.

Future research

The result of the present research should be confirmed by study on a large sample size.

Limitation

The limitation of this study was a smaller sample size.

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