Intra-rater reliability of cervical sensory motor function and cervical reconstruction test in healthy subjects

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ABSTRACT

Impairment of cervicocephalic and head joint position sense has an important role in the recurrent and chronic of cervicocephalic pain. The various tools are suggested for evaluating the cervicocephalic joint position sense. Although reconstruction of cervical angle is a clinical criterion for measuring the cervicocephalic proprioception, the reliability of this method has not been completely accepted. The purpose of this study was to evaluate intra-rater reliability of cervical sensory motor function and cervical reconstruction test in healthy subjects. twenty four healthy subjects (25.70±6.08 y) through simple non-probability sampling participated in this single-group repeated-measures reliability study. Participants were asked to relocate the neck, as accurately as possible, after full active cervical flexion, extension and rotation to the left and right sides. Five trials were performed for each movement. Laser pointer was used in head of patient. The distance between zero spot and joint position which patient had been reconstructed, was measured by centimeter. Intra-class correlation Coefficient (ICCs) and Pearson's correlation coefficient test was used to determine intra-rater reliability of variables. The results showed that intra-class correlation Coefficient (ICCs) values with 95% confidence interval (CI) and the standard error of the measurement (SEM) were good to excellent agreement for a single investigator between measurement occasions. Intra-class correlation Coefficient (ICCs) values were obtained for flexion movement (ICCs:0.75, good), extension movement (ICCs:0.81, very good), right rotation (ICCs:0.64, good) and left rotation (ICCs:0.64, good). The cervicocephalic relocation test to neutral head position by laser pointer is a reliable method to measure cervical sensory motor function. Therefore, it can be used for evaluating cervicocephalic proprioception of patient with cervicocephalic pain.

Key words: Reconstruction of Cervical Angle, Intra-Rater Reliability, Sensory Motor Function, Laser Pointer.

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INTRODUCTION

Proprioception is a common expression used for the description of [efferent or afferent] elevator data by afferent's proprioceptors on central nervous system path to control neuromuscular movement and is included joint kinaesthesia and joint position sense[1]. Proprioception afferents of cervicocephalic muscular are played important role on pasture control and walking. In fact , when the performance of cervicocephalic muscular nerve had defected by pathology, trauma and manipulation such as vibration and fatigue, the control of walking and balance would be detected[2]. Clinically, the outcomes of change of cervicocephalic mechanoreceptors sensivity may be a sign of dizziness, light headness signs, impairment of balance and reduction of neuromuscular protection. Therefore, performance of proprioception system as one balancer shouldn't be forgotten[3]. In the other word, proprioception evaluation and assessment must be done by physiotherapist [3].

As a result, in order to evaluate the ability of cervicocephalic proprioception, the reliability and validity instruments are very important. Although, the various test and instruments for evaluation cervicocephalic proprioception have been explained, there was controversy about evaluation of cervicocephalic proprioception ability in cervical spine

[2].Several clinical tests were designed for evaluation proprioception ability in cervical spine. To evaluate cervical sensory motor function, one of suggested clinical test is Cervicocephalic relocation test. This test was described by revel et al 1991 years [2]. the reliability of this test hasn't been sufficiently investigated[4].In these tests, there were differences between results from higher repetition level[5] to fewer repetition [1]level [4].The cervicocephalic relocation test to neutral head position is performed by laser pointer and this test is very user-friendly[6]

There are several studies which they indicated reliability of this tool [1,2,7]. Pinsualt et al. [2008] showed that there is a median to high reliability level [ICC= 0.39-0.78] in cervicocephalic relocation test to neutral head position. They reported that the reliability of this test increase with enhancement of repetition numbers [2]. Rex et al. [2001] measured kinesthesia sensibility in subjects with chronic pain in cervicocephalic and healthy subjects. they observed a few impairment in patient with non-traumatic cervicocephalic pain in kinaesthesia sensibility[7].Also, Strimpakos et al. [2006] evaluated test and re-test inter-tester reliability of cervicocephalic joint position sense and reported its reliability for all cervicocephalic movements from low to median level[ICC=0.01-0.50][1].Jorgenson, et al. [2013] studies test and re-test and inter tester reliability in healthy subjects and subjects with cervicocephalic pain and reported an pain between low level [0.02] and good level [0.66]and aren't suggested the use of this test[4].Whereas, a same study was performed by juul, et al. [2013] who reported this measurement from median to nearly high level [ICC≥0.48-0.82][8].A study was performed by Chen et al. [2013] who evaluated several measurement methods for cervicocephalic position sense in patient with cervicocephalic pain and healthy subjects which ultimately supposed joint position error torsion test more suitable than traditional method due to the elimination of vestibular system[9].In another study, Swait et al. [2007] studies head repositioning and head-tracking errors in normal or healthy subjects. They obtained the most repetition with 5 repeat times or more than it [0.73-0.84][10].Another study was performed by Roren et al. [2008] in order to compare usual method which introduced by River and 3-dimentional method with ultrasound method among patients with cervicocephalic pain and healthy subjects. The results was indicated that maximum mistake rate for patients with cervicocephalic pain in both methods. Also, the repetition for both methods was reported as median rate [ICC=0.68][11].

In spite of, there were various and several study about reliability cervicocephalic position and proprioception. In these studies, the different results are obtained from different repetitions number and differences are observed in applied methods. Therefore, the purpose of this study was to evaluate intra-rater reliability of cervical sensory motor function and cervical reconstruction test in healthy subjects.

MATERIALS AND METHODS

Study design
This study was a Single-group repeated-measures reliability study. Twenty four healthy subjects through simple non-probability sampling participated in this study. This study was done at Physiotherapy Clinic, Zahedan University of Medical Sciences. All participants signed written informed consents.

Participants
Twenty four healthy subjects with mean age 25.70±6.08 years participated in this study. Their demographic characteristics are shown in Table 1. Inclusion criteria were without history of cervicocephalic pain requiring medical care and age between 18 and 45 years. Subjects were excluded if they had current or previous neck pain, a history of trauma or previous surgery at cervical region (7, 9).

Data collection
Firstly, demographic data; Age, height, weight, and body mass index (BMI) were measured.

All measurements were performed by one physiotherapist. Subjects evaluated in two terms with interval 12 hours(7-9, 11, 12).

In order to test, the subjects sat directly on a chair whereas chair had a dorsal support in thorax and lumbar area and legs were completely settled on earth. Femoral and knee joint placed on 90 degree of flexion movement. A chair placed on interval one meter of grind plate attached to wall and opposite the patient. In order to decrease the limitation of head movement, Laser pointer fixed on patient head. The vertical interval of pointer to grind plate on wall measured again and tester has ensured to create the interval one meter between pointer and wall. Also, tester ensured about head and cervicocephalic natural position and a direct look at wall (patient looked at forward directly).laser's contact point and grind plate as source point was marked. Then, the patient closed his eyes and to ensure for doing this action, the cover was to close the eyes.

Again, the primary and normal position was reconstructed for patient, so that laser point and past original point overlapped. Thus patient was asked to remember this position. Then, patient was done by randomly one of movement including flexion, extension, left and right rotation movements in cervicocephalic. In order to perform flexion movement, patient was asked to near his chin to thorax, then returns carefully with primary and normal position, the new point was marked by patient who introduced as a primary position. In order to perform the extension movement, patient was asked to look at roof and again reconstructed primary position and in order to perform the relocations, patient was asked to relocate his/her head to right and left direction and reconstructed primary position.

The patient was asked to perform all movements with maximum movement range. Test reported in each direction for five times. The interval between zero point and joint position which patient had been reconstructed was measured by centimeter and became degree by helping right triangle calculation program's designed software. To initiate each new movement, tester adjusted manually the patient head in normal position and hasn't presented optic or verbal feedback during test for patient .before testing; the subjects were performed to test one trial and learning stage. The speed of test performance hasn't controlled. Therefore, it recommended subjects who perform the test with desirable speed(6, 8, 13, 14). Another time, all this method with 12 hours similar stages were performed for evaluating test re-test repetition.
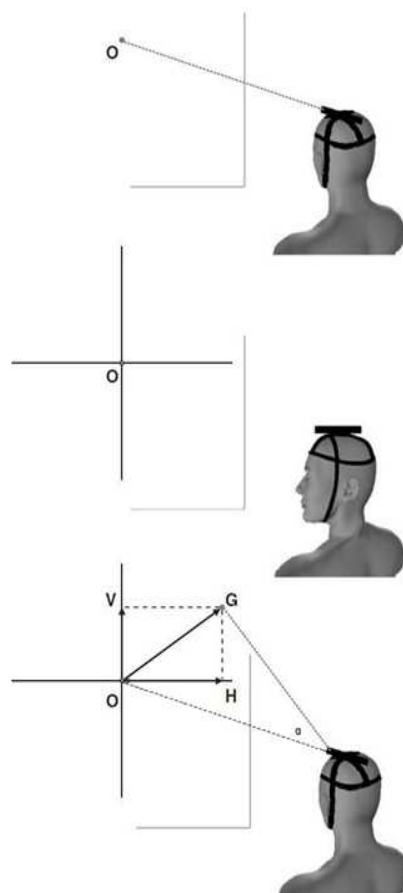
Figure 1. The execution of the cervicocephalic relocation test to the neutral head position required subjects, with eyes closed

Statistical Analysis
Results were presented as mean values and standard deviation (SD). Criterion of significances was set as $p < 0.05$.

Kolmogrov-Smirnov test was used to describe normal distribution. Intraclass correlation coefficient (ICC) Pearson's correlation coefficient test was used to determine intra-rater reliability of variables.

RESULTS

In recent study, twenty four healthy subjects with mean aged 25.70 ± 6.08 years participated that anthropometric specification has been reported in table 1.

Table 1:Demographic characteristics of subjects

	Mean	Standard Error	Std. Deviation
age	25.71	1.24	6.08
weight	61.88	1.58	7.72
Hight	164.54	1.09	5.33
BMI	22.82	0.48	2.35

The result of kolmogrov-smirnov test showed that all of variables had normal distribution (p> 0.05).

The descriptive amounts for studied variables in two terms of evaluation are showed in table 2.

Table 2: Descriptive statistic of variables

variables	Mean ± SD	
	First trial	Second trial
Flexion*	5.48±2.40	4.96±1.97
Extension*	6.25±3.13	6.62±2.53
Right Rotation*	6.22±2.13	5.90±2.11
Left Rotation *	6.26±2.58	6.09±1.70
Flexion**	3.14±1.37	2.83±1.14
Extension **	3.58±1.78	3.79±1.45
Right Rotation **	3.55±1.22	3.38±1.21
Left Rotation**	3.58±1.48	3.48±0.97

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Table 3: Intraclass correlation coefficient (ICC) Pearson's correlation coefficient test

Variables	Pearson(r)	cronbach's alpha	ICC	Lower Bound	Upper Bound	SEM1	SEM2
Flexion*	0.61	0.75	0.75	0.41	0.89	0.49	0.40
Extension*	0.69	0.81	0.81	0.55	0.92	0.64	0.52
Right Rotation*	0.47	0.64	0.64	0.17	0.84	0.43	0.43
Left Rotation *	0.51	0.64	0.64	0.16	0.84	0.53	0.35
Flexion**	0.61	0.75	0.75	0.41	0.89	0.28	0.23
Extension **	0.69	0.81	0.81	0.55	0.91	0.36	0.30
Right Rotation **	0.47	0.64	0.64	0.16	0.84	0.25	0.25
Left Rotation**	0.51	0.64	0.64	0.15	0.84	0.30	0.20

The statistical results are showed that there is a good level of test reliability in the reconstruction of cervicocephalic flexion angle (ICC=0.75, r=0.61). The statistical result are showed that there is a very good level of test reliability in the reconstruction of cervicocephalic extension angle (ICC=0,81 , r=0.69). The statistical are results are showed that there is a good level of test reliability in the reconstruction of cervicocephalic right rotation angle (ICC=0.64 , r=0.47). The statistical are results are showed that there is a good level of test reliability in the reconstruction of cervicocephalic left rotation angle (ICC=0.64 , r=0.51).

As you are observed in table 3 ,based on ICC amounts , the rate of agreement for evaluating flexion , right rotation and left rotation and also deviation rate of these movements based on degree had been good and the ICC amount for extension movement and deviation rate based on degree obtained by very good degree[15].

DISCUSSION

The finding of this research showed that there were moderate to high intra-rater reliability of cervicocephalic proprioception at four main directions had been pleased.

In many researchers and papers have been reported the reduction of kinaesthesia ability, reduction of movement sense and reduction of patient control with cervicocephalic pain result from trauma and or cervicocephalic pains without special cause[6, 13, 16, 17].The impairment created on motor nervous control in automatic from will not return to its normal performance if pain eliminated. Therefore, failure of motor nervous control such as impairment of cervicocephalic and head joint position sense can be played impairment role on recurrent and chronic of cervicocephalic pain which this fact has been presented in many studies(18-20).

The result of our study are similar to results which reported by Pinsault et al, so that they reported well the repetition of this test on active relocation movement with 5 repetition times (ICC=0.72)(2).The reason can be related to use the same measurement method and also the studied society which had included healthy subjects. Alexandra et al reported, median repetition (ICC=0.68) for this method such as out study(11).In addition, another studies were

performed that repetition of this method determined(5, 6, 8, 10, 21-24)in these studies, the use of this method for evaluating the cervicocephalic proprioception in clinic has been suggested. A study was performed by Rex in 2001 year who hasn't observed impairment of cervicocephalic joint position sense in patient with cervicocephalic pain, fewer numbers of samples can be considered as a reason of this difference between the results of our study and study suggested by Rix (2001).There is another difference in this study which includes 10 repetitions for each movement. Whereas, in a study was performed by Pinsualt who showed to decrease ICC amount by more repetition. There is a possibility that head tracking test to neutral head position is required attention and knowledge. In previous studies observed that tests are reported, the learning, fatigue and loss motivation and attention effect is unavoidable (2, 25). By contrast, studies such as Jorgensen (2014), Strimpakos (2006), ICC amount for this method obtained at low level. Therefore, they aren't considered durable method. In these studies 3 repetitions have been used, whereas many studies confirm the repetition number for obtaining the most stable and careful and accurate evaluation, thus, 3 repetition times may be insufficient to ensure the idea evaluation. In addition, the difference of measured methods is another cause of difference in the obtained results. Also, the subjects' age increase who had participated in these studies compared with our study can be one effective factor in these results. The active movement were performed during test which required to act the cervicocephalic frontal and dorsal muscular in all layers. in spite of spindle muscles are significantly participated body position sense , these results probability are showed the spindle muscle activity decrease with age increase because , agonist and antagonist participate proprioception data.

To decrease the sensibility of cervicocephalic kinaesthesia in difference directions is indicated to increase the sense activity of cervicocephalic muscular. Also, joint proprioception which able to bear the weight (such as cervicocephalic) is decrease with age increase(26).in one study was performed by Chen et al who presented JPE torsion method is more suitable than traditional method due to elimination vestibular system(9).

Whereas , it observed that vestibular system is active in high speeds and also has not been observed on those who have that failure of vestibular system compared with JPE's increase control group(27, 28).

The result of this study showed that cervicocephalic relocation test to neutral position is a durable criterion for the clinical measurement of cervicocephalic proprioception. As the impairment of kinaesthesia abilities and performance is caused to impair the movement and movement control, the study of this aspect of outcomes and impairments is considered as a necessary part of evaluation program and rehabilitation care. as a result, to return the kinaesthesia abilities has been recommended as medical involvements purposes and also has been suggested that should be evaluated among subjects with cervicocephalic pain. Therefore, it is important that consistency data about proprioception changes collected in order to evaluate the medical involvement effect.

CONCLUSION

Based on the findings of this study, there were moderate to high intra-rater reliability to measure cervicocephalic proprioception. Therefore, we conclude that Laser Pointer is a reliable tool to measurement of cervicocephalic proprioception in healthy subjects.

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