

## NORMATIVE VALUES AND INTER-RATER RELIABILITY OF DEEP NECK FLEXOR MUSCLE ENDURANCE TEST

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### ABSTRACT

Deep neck flexor muscle endurance test is valuable in assessment of patients with forward head posture, neck pain, migraine & headache. Little data is available regarding normative values of DNF muscle endurance test in Indian population. The current study established the normative data for performance of deep cervical flexor muscle endurance test in a group of active males and females. Ninety asymptomatic subjects were divided in three age groups (20-30yrs., 30-40yrs. & 40-50yrs.) & inter-rater reliability was tested. Normative values obtained for three age groups, 20-30yrs., 30-40yrs., 40-50 yrs. were 61.9±13.6, 58.6±10.6 & 54.6±10.6 respectively. Inter-rater reliability is analyzed by using Intra Class Correlation Coefficient (ICC). Value of ICC obtained is positive i.e. 0.91(0.87-0.94).

**KEYWORDS :** DNF muscles, Endurance Test, Normative Values, Inter-Rater Reliability

Neck pain is a common problem in community affecting more than 50% of the population at sometime in their lifetimes (Michel Guez, 2006). It is often associated with decrease in strength & endurance of neck musculature, which includes superficial & deep Flexor and extensor muscles of neck. Further Deep neck flexor (DNF) muscles include Longus Colli, Longus Capitis Anterior & Longus Capitis Lateralis which perform cranio-cervical flexion along with stabilization of cervical spine (Kevin D. Harris, Darren M Heer, 2005). A Decrease in the strength & endurance of DNF muscles has been reported in patients with forward head posture, neck pain, migraine and headache, thus making the endurance test of DNF muscles important in assessment of neck pain in patients suffering from these disorders. The endurance test is less utilized in clinical practice because of poor availability of normative data. Reference values of DNF endurance test are available in Australian population (Anthony Barber, 1994) but no similar data is available for Indian Population. There is lack of availability of easily applicable & reliable method to check the endurance of DNF muscles. Major difficulty in assessing DNF muscles is isolating their contribution in cranio-cervical flexion from that of superficial muscles (SCM & Anterior scalene muscle). Recent electromyography (EMG) studies suggest that the contribution of DNF muscles is maximum in causing cranio-cervical flexion while neck in chin-tuck position (Falla DL, Dull Alba P et.al., 2003). Therefore a procedure conducted while maintaining chin tuck position is supposed

to be more effective in measurement of performance of DNF muscles. Grimmer, Blizzard & K.D.Harries carried out DNF assessment studies with some variations in the procedure. But Grimmer & Blizzard reported only intra-rater reliability and K.D. Harries reported both inter-rater & intra-rater reliability of DNF muscle endurance test but no standardized equipment was used in his study. Objective of this study was to report the normative values of endurance of deep neck flexor muscles in different age groups and to check the inter-rater reliability of DNF muscle endurance test while using sphygmomanometer in a modified way.

### MATERIALS AND METHODS

A cross sectional study was carried out in students and employees of Maharishi Markendeshwar University Mullana, Ambala. Only one variable that is the hold time noted by two raters was observed. A convenient sample of 90 healthy subjects aged from 20-50 yrs. was taken. All subjects who had no present complaints of neck pain and were following active life style according to General Practice Physical Activity Questionnaire (Department of Health, UK GOVT., 2004) were included in the study.

Subjects were examined and those who met the inclusion criteria were divided equally in to three age groups that is 20-30yrs. 30-40yrs. and 40-50 yrs. after signing a consent form following a detailed explanation by an investigator. The subjects were assessed for neck flexor muscle endurance test after recording necessary demographic data. The data was analyzed using SPSS 13.0

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software package. Inter-rater reliability was analyzed by calculating Intra-class Correlation Coefficient (ICC) and variance between three groups was analyzed by using one way analysis of variance (ANOVA).

Instruments used in the study were Stopwatch, Sphygmomanometer, Plinth & General Practice Physical Activity Questionnaire.

The participants were excluded if they had a history of thoracic or cervical spinal surgery, known cervical abnormalities, known systemic, muscular or connective tissue disorders, a history of significant injury to neck or upper thoracic spine or symptomatic cervical joints upon cervical spine palpation.

#### **Neck Flexor Muscle Endurance Test**

The neck flexor muscle endurance test used in this study was performed in a supine, hook lying position and was operationally defined as follows: with the chin maximally retracted and maintained iso-metrically, the subject lifted the head and neck until the head was approximately 1 inch above the plinth while keeping the chin retracted to chest. Once in position, stop watch was started and an inflated cuff of sphygmomanometer was placed under the occiput of subject. The head was just touching the inflated cuff and not resting over it. The mercury level was observed throughout the test procedure. The test was terminated if any rise in mercury level is observed. This method was adopted because the appearance of skin folds may not be clearly visible in lean subjects hence limits the use of test method used by K D Harries in these subjects.

#### **Testing Procedure**

Two raters trained in application of neck flexor endurance test performed all testing. Each rater alternated being the first rater. Each subject was positioned by the first rater and provided with verbal instructions (“Tuck your chin in and lift up your head”) and pictures depicting proper performance of test. The rater then guided through the motions required for performance of test two times. Following the instructions and guidance through the test procedure, the subject was asked to perform the test operationally defined. A stop watch was used to measure the length of time (in seconds) that the subject could hold the

test position. Measurements were recorded to nearest second. Following conclusion of this test, the first rater removed the inflated cuff of sphygmomanometer and instructed the subject to rest for 15 minutes. During this time, subject was instructed to remain in supine and turn his or her neck from side to side through full range of motion at least 3 times without raising the head from table. The first rater then departed the room, and the second rater entered and repeated the same procedure. Test session for each subject lasted approximately 30 minutes.

#### **RESULTS AND DISCUSSION**

Normative values obtained by both raters are summarized in table 1 and no significant difference was found among three age groups. Inter-rater reliability obtained was positive i.e. 0.91 and ranged from 0.87 to 0.94. A scatter diagram shown in figure 1.

The inter rater reliability of deep neck flexor muscle endurance test in the current study is good, similar to Kevin D. Herris, 2005 who reported moderate to good inter-rater reliability for subjects without neck pain observing the breakage in continuity of line drawn across the approximated skin folds in neck region while performing cranio-cervical flexion with keeping the chin tucked in. The result of current study agree with clinometric evaluation done by H P Chantal De Koning, 2008 who reported that ICC values calculated for inter-rater reliability ranged from 0.57 to 1.00 in different studies. The difference might be attributed to instrumentation, patient position, test termination criteria (Lariviere C. and Gravel D., 2003).

The chin tuck position is regarded best (Chantal HP de Koning et.al., 2008) and is supported by EMG study done (Falla D. L., Dull Alba P. et. al., 2003). The sphygmomanometer is used in modified way in this study. The use of pressure sensor mechanism of the sphygmomanometer is justified by its use in evaluation of muscle strength and force measurements in previous studies (Claudionor Delgada et. al., 2004).

Fifteen minutes time interval is also suggested in literature (Cleland J. A., Childs J. D., 2006) as rest period between multiple fatigue test.

The clinical relevance of this study lies in the fact

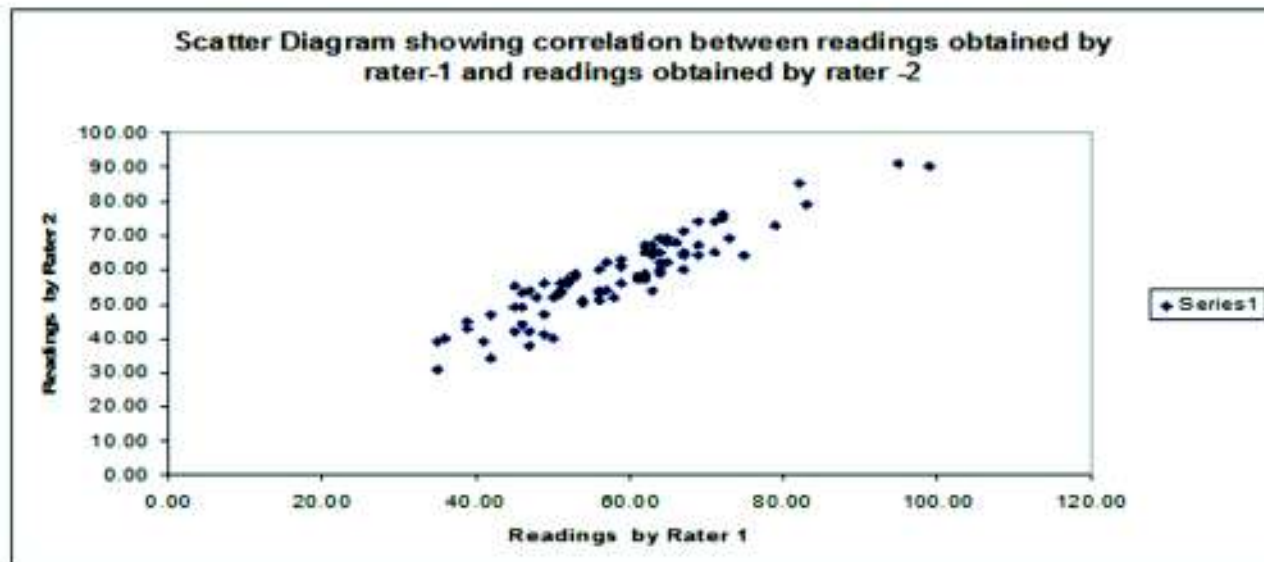


Figure 1 : Diagram correlation between normative values of two raters

Table 1 : Normative values reported by 2 raters according to age

Group	Age (Yrs.)	N	Rater-1(sec.)	Rater-2 (sec.)
1	20-30	30	61.9 ±13.6	61.6 ±12.1
2	30-40	30	58.6 ± 10.6	58.2 ±10.2
3	40-50	30	54.6 ± 10.6	54.7 ±11.2
Total		90	58.4 ± 11.9	58.1 ±11.4

that the study provides a cost effective, easily applicable and reliable method for measuring endurance of deep neck flexor muscles.

The current study established the normative data for performance of deep cervical flexor muscles in a group of active males and females. This study also states that inter-rater reliability of neck flexor muscle endurance test is good.

The normative values obtained from this study can be used as reference values after carrying out larger study for assessing endurance of deep neck flexor muscles in patients with forward head posture, cervicogenic headache and chronic neck pain patients. It is recommended to find out sex specific normative values and to check the test reliability in neck pain patients.

Sample size taken was small. Radiographic findings for degenerative changes and diurnal variations were not considered.

REFERENCES

Anthony Barber, 1994. Upper cervical spine flexor muscles: Age related performance in asymptomatic women. *Australian Physiotherapy*, **40**: 167-170.

Chantal HP de Koning., 2008. Clinimetric evaluation of methods to measure muscle functioning in patients with non-specific neck pain: A systematic review. *BMC Musculoskeletal Disorders*; **9**:142-147.

Claudionor Delgado, 2004. Use of sphygmomanometer in the evaluation of knee joint flexor and extensor muscle strength in militaries. *Rev Bras Med Esporte*; **5**: 231-235.

Cleland J. A. and Childs J.D., 2006. Interrater reliability of the history and physical examination in patients with mechanical neck pain. *Arch Phys Med Rehabil*. **87(10)**: 1388-1395.

Department of Health, Government of UK. URL: [http://webarchive.nationalarchives.gov.uk/20080910134953/dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH\\_063812](http://webarchive.nationalarchives.gov.uk/20080910134953/dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_063812). Last accessed on 26/11/2008.

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- Falla D. L. and Dull Alba P., 2003. An electro-myographic analysis of deep cervical flexor muscles in performance of cranio-cervical flexion. *Physical Therapy*, **83**: 899-906.
- Grimmer K., 1994. Measuring the endurance capacity of cervical flexor muscle group. *Aust. J Physiothera.*, **40**: 251-254.
- Kevin D. Harris and Darren M Heer; 2005. Reliability of measurement of neck flexor muscle endurance. *Physical Therapy*; **85**:1349-1355.
- Lariviere C. and Gravel D., 2003. Muscle recovery from a short fatigue test and consequence on the reliability of EMG indices of fatigue. *Eur. J. Appl. Physiol.*; **89(2)**: 171-176.
- Michel Guez, 2006. Chronic neck pain: An epidemiological, psychological and SPECT study with emphasis on whiplash associated disorders. *Acta Orthopaedica*; 77; supplimentum no.320.