INTRATESTER AND INTERTESTER RELIABILITY OF MEASURING THE UPPER LIMB NEURODYNAMIC TEST 1 IN ASYMTOMATIC SUBJECTS

Rawiporn Pithak[1,2], Rungthip Puntumetakul[2,*], Orawan Buranruk[2], Kurusart Konharn[2], Rungthip Chalermsan[2], and Pongsatorn Saiklang[2].

[1]*Physical Therapy Program, Graduation School, Division of Physical Therapy, Faculty of Associated Medical Sciences, Khon Kaen University, Khon Kaen, Thailand*
[2]*Research Center in Back, Neck, Other Joint Pain, and Human Performance (BNOJPH), Khon Kaen University, Khon Kaen, Thailand*
**e-mail: rungthiprt@gmail.com*

Abstract

The Upper Limb Neurodynamic Test 1 (ULNT1) is a useful technique in clinical practice to assess a neuraltension in musculosketal disorders. However, the evidence regarding its reliability isunclear. Therefore, the purpose of this study was to determine the intra- and intertester reliability of the ULNT1 on an asymptomatic population. Eleven asymptomatic subjects, aged between 20-36 years (mean 26±4.7 years) were recruited in this study.The ULNT1 was performed twice on the dominant arm of each subject by two experienced physical therapists based on standard process of upper limb provocation test. Elbow extension range of motion was measured at the threshold level (P1) and tolerance level (P2) using a digital goniometer. Intraclass correlation coefficients (ICCs) were conducted to quantify reliability. The results demonstrated that Intratester reliability for P1 was excellent with an $ICC_{(2,1)}$ ranging from 0.85 to 0.88. Intratester reliability for P2 was excellent with high reliability (ICC values ranged from 0.96 to 0.97). Intertester reliability was excellent for both P1 and P2 (ICC values ranged from 0.81 to 0.92). These finding demonstrates that the ULNT1 can be used in physical examination to identify an impairment of neural tissue in upper limb and neck disorders with high reliability.

Keywords: Upper Limb Neurodynamic Test, reliability, neurologic examination, neural tension

Introduction

Neural tissue has been reported as a possible source of signs and symptoms on neck pain (Bogduk and Aprill1993; Bogduk 2009). The characteristics of causes of neck pain such as repetitive movement, awkward posture, and sitting work more than 95% of working day (Makela et al. 1991; Cote et al. 2000; Cote et al.2003) can bring about the biomechanical and physiological changes of neural tissue which resulting in increase of neural tension (Dommisse 1975; Butler 1989).

The neural tissue provocation tests are usually used in clinical examination to identify mechanosensitivity of neural tissue as a potential source of pain (Butler 1991). These tests compose of the sequence of passive movement in order to assess mechanical and physiological functions of neural tissue (Coppieters et al. 2002). Moreover, it can be used as an evaluation of the efficacy of physical therapy treatment.

The Upper Limb Neurodynamic Test 1 (ULNT1) is widely used as a neural tissue provocation test for assessment of patient with neck and upper limb disorder (Butler 1991).Although this test is widespread used in a part of clinical assessment, few studies have been done toinvestigate its intra- and intertester reliability with asymptomatic subjects (Hines et al. 1993; Heide et al. 2001; Coppieters et al.2002; Vanti et al. 2010).

In addition, this study which determined the reliability of ULNT1 measurement was a part ofthe study about the comparison in immediate effects of single thoracic manipulation and special massage technique (RT technique) on chronic mechanical neck pain. The aim of this study was to measureintra- and intertester reliability of the ULNT1 on asymptomatic subjects.

Methodology

Subjects

The participants included 11 asymptomatic subjects (3 men and 8 women) between 20 to 36 years old (mean age 26±4.73). The inclusion criteria required participants who have full range of motion of upper limb joint which cannot prevent ULNT1 testing (Vanti et al. 2010). Exclusion criteria were: (a)history of cervicobrachial pain or onset musculoskeletal pain on the upper quadrant; (b)any physical contraindication for physical therapy (e.g. infection, tumor, or fracture); and (c) the presence of any cognitive or communicative deficits which would prevent the patient from providing accurate feedback during the test (Coppieters et al. 2002).

Materials and measurements

The dependent variables were range of motion (ROM) of elbow extension measured by a digital goniometer. The digital goniometer was calibrated at 0º elbow extension ROM with universal goniometer before testing procedure.

Procedure

All the experiments were conducted at the physical therapy laboratory of Faculty of Associated Medical Sciences, Khon Kaen University, Thailand.

Prior to ULNT1, the subjects were informed about the test procedure and were asked to verbally communicate abouttheir onset response andthe location of symptoms during the test.*P1* (threshold level) was defined as the first moment when symptoms (e.g. strain, tightness, tension, numbness, pins and needles) was felt on the tested upper limb, whereas, *P2* (tolerance level) was defined as the most excessive strain or painful (Vanti et al., 2010). The data was recorded when the subject pronounced the word '*strain*' and '*stop*' respectively.

The ULNT1 protocol as described by Butler (Butler 1991) was performed on the dominant upper limb of each participant by two investigators; both are physical therapists who had been working in the field of musculoskeletal physical therapy for 6 and 3 years respectively. Subjects were tested in supine position on an examine bed without pillow and with their cervical spine in neutral position. The shoulder girdle was stabilized without any external device to control it, after that the shoulder was abducted to 110º by a stainless block which was designed to fix the range of shoulder abduction, then the wrist and fingers were extended, the forearm was supinated, the shoulder was laterally rotated to 90º, and lastly the elbow extension was performed. The examiner executed the test whileaccurately maintained earlier component positions before adding the next component.Elbow extension ROM was recorded when P1 and P2 occurred by assistance researcher using the digital goniometer.The axis of digital goniometer was positionedon subject's medial epicondyle of humerus. The stationary arm of the goniometer was aligned with the midline of humerus and the moveable arm was aligned parallel with the midline of ulna (Lohkamp and Small 2011).For each subject, the first examiner will be randomized. The examiners performed 2 repetitions of the test. There was 5 minutes rest break between the trials repetition and between the testers.

Statistical analysis

Data were analyzed with SPSS for Windows version 17. All descriptive data are reported as mean and SD. For analysis of intra- and intertester reliability, it was conducted with two-way random effects single measure reliability model (model 2,1), intraclass correlation coefficients (ICCs), and corresponding 95% confidence intervals (95% CIs). In interpretation of the ICCs, this study used the criteria following Coppieters et al. to identify the reliability coefficients: ICC less than 0.4, poor reliability; ICC at 0.40 – 0.69, fair reliability; ICC at least 0.70 but less than 0.90, good reliability; and ICC at least 0.90 was definedas excellent reliability (Coppieters et al, 2002). For all analyses, $P < .05$ was considered to be the level of significance.

Results

There were 11 asymptomatic subjects that participated in this study. The mean age of the subjects was 26 ± 4.7 years. The mean ROM for P1 recorded in dominant arm was 114.8º±8.8º, whereas for P2, it resulted to 137.2º±14.8º.The intratester reliability for all measures ranged from 0.85 to 0.97 (Table 1). Intratester reliability of P2 was higher than P1. For intertester reliability using data from mean of 2 repetitions of the ULNT1 for each examinerwas in good range for P1 (ICC = 0.81), but was in excellent range for P2 (ICC = 0.92) (Table 2). Regarding to intertester reliability between examiner 1 and examiner 2, the ICCs were higher in P2 than P1.

Table 1 Intratester reliability of P1 and P2 (n = 11)

	Examiner 1		Examiner 2	
	ICC	95% CI	ICC	95% CI
P1	0.85	(0.43 – 0.96)	0.88	(0.54 – 0.97)
P2	0.96	(0.84 – 0.99)	0.97	(0.87 – 0.99)

Table 2 Intertester reliability of P1 and P2 (n = 11)

	ICC	95% CI
P1	0.81	(0.28 – 0.95)
P2	0.92	(0.69 – 0.98)

Discussion and Conclusion

This study purposed to determine theintra- and intertester reliability of the ULNT1 on asymptomatic subjects. The results indicated good to excellent intra- and intertester reliability of ULNT1 by measuring elbow extension ROM in the dominant arm.The intratester reliability $ICC_{3,1}$ values ranged from 0.85 to 0.97 were found for both raters. The findings are similar to previous investigations (Coppieters et al. 2002; Vanti et al. 2010; Oliver and Rushton 2011). The present results involving intertester reliability of P1 and P2 in asymptomatic subjects were consistent with those previous studies (Byng1997; Coppieters et al. 2002; Vanti et al. 2010) with a stronger reliability ($ICC_{2,1}$ 0.81 for P1; 0.92 for P2) than what others studies have found (Coppieters et al. 2002; Vanti et al. 2010; Oliver and Rushton 2011).

In contrast to other investigations, this current studyapplied external device to maintain the position of shoulder abduction in 110º for control the movement which might cause more tension of neural tissue or influence the range of following components of ULNT1. Moreover, there was a randomization forsequence of the examiner to prevent the bias. In addition, although previous studies found no difference in elbow extension between both arm for the ULNT1 measurement (Heide et al. 2001; Oliver and Rushton 2011), our study used the dominant arm of the subjects for testing.

Finally, measurement by an experienced physical and a graduate student with experience in assessment of ULNT1 showed similar results of intra- and intertester reliability. We found that both testers have high reliabilities but these results seem to be slightly better in more experience physical therapist. This observationhas been described in previous study (Vanti et al. 2010).

The current study has some limitations including the procedure of ULNT1 measurement which has been used the external deviceonly in the sequence of shoulder abduction during the testto maintain a range of motion.Therefore, further study may consider improving reliability measurement method by using other external devices to control thehead in a neutral position and a force that applied for preventing shoulder girdle elevation during the process of measurement because the tension that applied for one component can influence the next one (Coppieters, and Butler 2008; Vanti et al. 2010). Moreover,further researches are suggested to determine in symptomatic subjects such as patients with musculoskeletal disorder.

The findings of this study indicate good to excellent intra- and intertester reliability of ULNT1 for all subject parameters (P1 and P2) in asymptomatic subjects. It can be suggested that the ULNT1 measurement is reliablefor physical examination to identify an impairment of neural tissue orcan be used as an evaluation of the efficacy of physical therapy treatment

Acknowledgements

This project was supported by the Research Center in Back, Neck, Other Joint Pain, and Human Performance (BNOJPH), Khon Kaen University, Thailand.

References

1. Bogduk N (2009) On the definitions and physiology of back pain, referred pain, and radicular pain. Pain 147:17–19.
2. Bogduk N, April C (1993) On the nature of neck pain, discography and cervical zygapophyseal joint blocks. Pain 54:213-217.
3. Butler DS (1989) Adverse mechanical tension in the nervous system: a model for assessment and treatment. Aust J Physiother 35:227-238.
4. Butler DS (1991) Mobilization of the Nervous System. Melbourne, Australia: Churchill Livingstone.
5. Byng J (1997) Overuse syndromes of the upper limb and the upper limb tension test: a comparison between patients, asymptomatic keyboard workers and asymptomatic non-keyboard workers. Man Ther 2:157-164.
6. Coppieters M, Stappaerts K, Janssens K, Jull G (2002) Reliability of detecting 'onset of pain' and ' submaximal pain' during neural provocation testing for the upper quadrant. Physiother Res Int 7:146-156.
7. Coppieters MW, Butler DS (2008) Do "sliders" slide and "tensioners" tension? An analysis of neurodynamic techniques and considerations regarding their application. Man Ther 13:213-221.
8. Côté P, Cassidy JD, Carroll L (2000) The factors associated with neck pain and its related disability in the Saskatchewan population. Spine 25:1109-1117.
9. Côté P, Cassidy JD, Carroll L (2003) The epidemiology of neck pain: what we have learned from our population-based studies. J Can Chiropr Assoc 47:284-290.
10. Dommisse GF (1975) Morphological aspects of the lumbar spine and lumbosacral region. Orthop Clin North Am 6:163-175.
11. Heide van der B, Allison GT, Zusman M (2001) Pain and muscular responses to a neural tissue provocation test in the upper limb. Man Ther 6:154-162.
12. Hines T, Noakes R, Manners B (1993) The upper limb tension test: inter-tester reliability for assessing the onset of passive resistance R1. J Manipulative Physiol Ther:95-8.
13. Lohkamp M, Small K (2011) Normal response to upper limb neurodynamic test 1 and 2A. Man Ther 16:125-130.
14. Makela M, Heliovaara M, Sievers K, Impivaara O, Knekt P, Aromaa A (1991) Prevalence, determinants, and consequences of chronic neck pain in Finland. Am J Epidemiol 134:1356-1367.
15. Oliver GS, Rushton A (2011) A study to explore the reliability and precision of intra and inter-rater measures of ULNT1 on an asymptomatic population. Man Ther 16:203-206.
16. Vanti C et al. (2010) The upper limb neurodynamic test I: intra- and intertester reliability and the effect of several repetitions on pain and resistance. J Man Phys Ther 33:292-299