



Incidence of Proprioceptive Deficits in Recurrent Lateral Ankle Sprain Among Young Adults

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ABSTRACT

Background: Recurrent Lateral ankle sprains results to poorer ankle proprioception that has higher risk of ankle injury. Ankle injuries often lead to disruption of muscles and tendons with associated damage to inherent mechanoreceptors, which detrimentally alter the quality of proprioception required for balance control.

Aim and Objectives: To study the incidence of proprioceptive deficits in recurrent lateral ankle sprain in young adults using Modified Rhomberg's test/ Single leg stance test (Eyes Open and Eyes Closed) and joint position sense by goniometric evaluation.

Methodology: Total 30 subjects fulfilling inclusion criteria were selected randomly, informed Consent was obtained. Modified Rhomberg test/ single leg stance test was performed affected and unaffected extremity, duration for which subjects can perform the test is noted. Second test was goniometric evaluation for joint position sense (JPS) of ankle for affected and unaffected extremity was documented and subjected for data analysis.

Results: the study included 15 males 15 females in study with mean Age 24 ± 4.651 . Modified Rhomberg test/ single leg stance test with eyes open ($p=0.000$) and eyes closed ($p=0.000$), Joint position sense ($p=0.000$) was statistically significant when compared from affected to unaffected extremity using Student t test.

Conclusion: Study concludes that there is incidence of proprioceptive deficits in recurrent Lateral ankle sprain in young adults.

Keywords: Modified Rhomberg test, Joint Position Sense, Proprioceptive deficits, Recurrent Lateral ankle Sprain.

INTRODUCTION

The ankle is one of the most common sites for musculoskeletal injuries and sprains which accounts for 75 % of ankle injuries.^[1]

Lateral ankle sprains account for 85% of all ankle sprains, the most common mechanism of injury

being inversion of the plantar-flexed foot.^[2] The mechanism of lateral ankle sprains is excessive supination of the rear-foot coupled with external rotation of the lower leg. The anterior talofibular ligament (ATFL) is the most commonly sprained lateral ankle ligament, followed by the

calcaneofibular ligament (CFL), and the rarely injured posterior talofibular ligament.^[3]

The grade of ankle sprain are as follows:

Grade I: Partial tear of a ligament, Mild tenderness and swelling. Slight or no functional loss (i.e., patient is able to bear weight and ambulate with minimal pain)

Grade II: Incomplete tear of a ligament, Moderate pain and swelling. Mild to moderate ecchymosis with moderate functional Tenderness over involved structures impairment Some loss of motion and function (i.e., patient has pain with weight-bearing and ambulation)Mild to moderate instability

Grade III: Complete tear and loss of integrity of a ligament, Severe swelling (more than 4 cm about the fibula) Severe ecchymosis, Loss of function and motion (i.e., patient is unable to bear weight or ambulate) Mechanical instability (moderate to severe positivity of clinical stress examination)^[1]

Manifestations of chronic ankle instability include recurrent ankle sprains, the sensation of the ankle 'giving way', pain, impaired performance during functional tasks, and perceived difficulties with activities of daily living.^[2]

Up to one-third of ankle sprains would develop chronic ankle instability (CAI).CAI is defined as a patient having persistent symptoms and sensations of the ankle "giving way" more than 12 months after initial lateral ankle sprain.^[3] Various factors contribute to chronic ankle instability which include diminished neuromuscular control, proprioception and postural control deficits, muscle weakness, impaired joint position sense, and ligament laxity which demonstrated balance and proprioceptive deficits in patients with chronic ankle instability.^[2]

Grade I and II Lateral ankle sprains lead to balance problems due to proprioceptive deficits, especially the unconscious (reflexive) part of proprioception as opposed to the conscious (voluntary) part which play probably an important role in recurrence of ankle sprain.^[4] The possible causes of high incidence of lateral ankle sprains and the high rate of re-injury resulting in chronic instability have been suggested as decrease in muscular strength of the ankle evertors, an increase in lateral ligamentous

laxity and proprioceptive deficits resulting from a disruption in the integrity of the joint mechanoreceptors.^[5]

Proprioception has been described as "a specialized variation of the sensory modality of touch which encompasses the sensations of joint movement (kinesthesia) and joint position sense". This afferent sensory feedback mechanism is found in peripheral mechanoreceptors namely surrounding skin, muscles, tendons, ligaments, and joints which respond to mechanical deformation by initiating action potentials that are conducted to and processed by the central nervous system thus an individual is able to perceive both movement (kinesthesia) and position (joint position sense) of a joint.^[5]

Proprioception has traditionally been assessed two ways, firstly Kinesthesia has been measured via the threshold to detection of passive motion (TTDPM) method, Secondly joint position sense has been documented as an individual's ability to reproduce a predetermined joint angle either actively or passively which can be tested using instruments ranged from the basic standard goniometer.^[5] Joint position sense is a measure of proprioception.^[6]

The assessment of proprioception within musculoskeletal research is evaluated by JPS, kinesthesia or sense of tension with JPS being the most commonly utilised measure. JPS is a measure of the participant's ability to reproduce predetermined angles, whether passively or actively. Ankle instability affects up to 50% of those who sustain an acute injury to the lateral collateral ligaments, and might persist as a chronic condition long after the signs and symptoms of the original injury have subsided. Impaired proprioception, muscle weakness, subtalar instability, and ligament laxity have been identified as contributing factors to chronic instability, this study showed than the ankle injury would significantly impair ankle proprioception.^[6]

Hence in this study we evaluated proprioceptive deficits using Joint position sense and single leg stance test or modified rhombberg's test to find the incidence of proprioceptive deficits in recurrent lateral ankle sprain among young adults.

AIM

- To study the incidence of proprioceptive deficits in recurrent lateral ankle sprain in young adults.

OBJECTIVES

- To find out proprioceptive deficits in recurrent lateral ankle sprain with the help of Modified Romberg's test/ Single leg stance test (eyes open and eyes closed)
- To find out proprioceptive deficits in recurrent lateral ankle sprain using Joint position sense of ankle with help of goniometric evaluation.

MATERIALS AND METHODOLOGY

STUDY DESIGN: Observational Study

STUDY MATERIAL: Pen, Book, Blindfold, Stopwatch, Plinth, Goniometer , Velcro straps.

SAMPLE SIZE: 30

INCLUSION CRITERIA

- Age: 18 – 39 years
- Both Males and females
- Recurrent unilateral ankle sprain: Grade 1 and Grade 2 (Sprain 6 months old treated conservatively).
- Subjects with ankle strength 4/5 or 5/5.
- No proprioceptive deficits in Hip and Knee joints

EXCLUSION CRITERIA

- Recent ankle sprain.
- Patient with neuro-deficits such as vestibular, balance, sensory or visual loss.
- Previous fracture, surgery at /around ankle or ligament injury of knee within a year.
- Bilateral chronic ankle sprain.
- Patients with Grade 3 ankle sprains.

PROCEDURE

Patients fulfilling the inclusion criteria were identified. Informed consent was obtained after a detailed explanation of the procedure to the subjects.

Modified Romberg test [Single leg stance]: Eligible subjects were asked to stand barefoot on the

limb of their choice on a stable surface, with the other limb raised so that the raised foot was near but not touching the ankle of their stance limb, no adduction of leg lifted up from ground. Each subject was asked to focus on a spot on the wall at eye level in front of him, for the duration of the eyes open test. Prior to raising the limb, the subject was instructed to cross his arms over the chest. A stopwatch was used to measure the amount of time duration the subject was able to stand on one limb. Time commenced when the subject raised the foot off the floor was noted for unaffected and affected extremity. ^[7]

Second test was assessment of joint position sense for ankle (JPS) which was performed by blindfolding the subject's eyes in supine lying position. The subject was asked to move his test limb to the predetermined target angle/position and let him feel that angle/position for 5 sec. Then the limb was moved to that target position passively wherein the subject was asked to move the limb to that target angle and patient's perceived angle was measured. ^[8]

RESULTS

- Mean Age was 24 ± 4.651 (15 males 15 females)
- Data analysis was done using students paired t test following are the results:

	Mean \pm SD	Mean \pm SD	P value
Modified Romberg's test (eyes open)	24.36 \pm 9.866	33.23 \pm 10.73	0.000
Modified Romberg's test (eyes open)	29.3 \pm 14.11	41.9 \pm 13.71	0.000
Joint position sense			0.000

DISCUSSION

The results showed that duration for Modified Romberg's test/ single leg stance test for affected to unaffected extremity was compared with eyes closed and open, both were statistically significant whereas comparison between degrees of joint position sense on unaffected and affected side was done, it showed that there was statistically significant difference between degree of joint position sense.

The proprioceptive deficits occurred after ankle sprain because of concomitant damage to the sensory receptors located in the injured ligaments, and subsequently the dynamic control of joint stability by the musculature surrounding the joint was compromised because of inadequate sensory information from the injured joint. Proprioceptive deficits associated with ankle ligament injury have traditionally been demonstrated via measures of active or passive joint position sense. Impairments of muscle spindle function in the muscles crossing the ankle joint, particularly the peroneal muscles, have also been implicated as source of sensory dysfunction associated with chronic ankle instability. Most recently, deficits in cutaneous sensory function have also been demonstrated in patients with Chronic ankle instability via diminished vibro-tactile sensation of the plantar cutaneous receptors and altered cutaneous reflexes along the distribution of the sural nerve. This range of sensory deficits is likely due to neural plasticity about the entire ankle complex in response to the lateral ligamentous injury. These sensory deficits are linked to alterations in both alpha- and gamma-motoneuron function. Motor control and behavior alterations due to ankle instability indicates the presence of arthrogenic muscle responses to lateral ankle ligament injury.^[3]

Young healthy adults should be able to balance on one limb with eyes closed for 30 seconds. In a study evaluating the relationship between the unipedal single leg stance test (UPST) and aging, normative values for each decade from 20 to 79 years of age for the eyes open and eyes closed conditions. In the third and fourth decade, subjects were able to maintain the UPST for an average of 28 to 29 seconds for both conditions.^[7]

With eyes open, unilateral standing balance on the involved limb was significantly lower compared with the sound limb. This result agrees with who all reported that impairment of proprioception has a major effect on balance after lateral ankle sprains. The results reveal that after Grade I and II lateral ankle sprains, balance problems occur and are a result of proprioceptive deficits, especially the

unconscious (reflexive) part of proprioception as opposed to the conscious (voluntary) part. This factor probably plays an important role in recurrence of ankle sprain.^[4]

Possible causes of underestimation may include disturbance of proprioception decreased tension of peroneal muscles and abnormal joint kinematics of both talo-crural and talo-calcaneal joints. Mechanoreceptors in ligaments and joint capsule, particularly the anterior talofibular ligament (ATFL), may be damaged during ankle sprain. The peroneal muscles reportedly suffer from proprioception deficits, weakness and the delay of the reaction time.^[9] Proprioceptive deficits have been implicated as contributing to balance impairments following lower extremity and trunk injuries or pathologies. Decreased joint position sense has been reported in individuals with recurrent ankle sprains, knee ligamentous injuries degenerative joint disease and low back pain.^[10]

Proprioceptive deficit manifested as decreased ability to perceive passive motion and development of balance impairments^[10]

The studies shows that there were significant proprioceptive deficits in chronic unilateral ankle sprain observed by Modified Romberg's test as it requires greater proprioceptive and cutaneous sensation along with motor participation to attain single stance position with eyes closed than eyes open on affected extremity than unaffected extremity, so proprioception deficits are significantly observed.^[11]

Similar reports of the relationship between ankle proprioception and ankle injury risk are also noted in the literature. For example, a longitudinal study found ankle proprioception could predict ankle injuries in college basketball players. In addition, basketball players with poorer ankle proprioception used an altered pattern of cocontraction of ankle plantar flexors and dorsiflexors, which in turn resulted in greater impact force at the moment of landing associated with higher risk of ankle injury. Ankle proprioception is one of the intrinsic factors associated with ankle injury, as identified by Witchalls et al. in their systematic review. Ankle

injuries often lead to disruption of muscles and tendons with associated damage to inherent mechanoreceptors, which detrimentally alter the quality of proprioceptive information required for balance control. Unrehabilitated, impaired ankle proprioception after ankle injury can subsequently result in long-term deterioration of postural and balance control.^[12]

CONCLUSION

The study concludes that there are significant proprioceptive deficits patients with chronic recurrent unilateral Lateral ankle sprain in young adults.

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REFERENCES

1. Management of Ankle Sprains, Wolfe MW, Uhl TL, Mattacola CG, mccluskey LC Am Fam Physician. 2001 Jan 1;63(1):93-104. Review. Erratum in: Am Fam Physician 2001 Aug 1;64(3):386
2. Evidence-based treatment for ankle injuries: a clinical perspective Chung-Wei Christine Lin , Claire E. Hiller , Rob A. de Bie Journal of Manual and Manipulative Therapy 2010 VOL. 18 NO. 1
3. Neuromechanics of ankle instability: rehabilitation implications, Jay Hertel international conference on biomechanics in sports ISSN 1999-4168, 2013
4. Balance problems after unilateral lateral ankle sprains, Mohammad Akbari, Mohammad Akbari, Hossein Farahini, Soghra Faghizadeh, Journal of Rehabilitation Research & Development, Volume 43, Number 7, Pages 819–824 November/December 2006, DOI: 10.1682/JRRD.
5. Intertester reliability of active and passive ankle joint position sense testing. Szczerba, J.E., Bernier, J.N., Perrin, D.H., & Gansneder, B.M. Journal of Sport Rehabilitation, Volume 4 , issue 4: 282-291, 1995. doi: <http://dx.doi.org/10.1123/jsr.4.4.282>
6. The influence of ankle sprains on proprioception Y-W Liu, Shiow-Chyn Jeng, Alex J. Y. Lee, J Exerc Sci Fit ,Vol 3 , No 1, pg 33-38,2005
7. Normative Values for the Unipedal Stance Test with Eyes Open and Closed, COL Barbara A. Springer, Journal of Geriatric Physical Therapy Vol. 30;1:07
8. Screening of proprioception of ankle joint in patients with diabetic neuropathy- an observational study, Jeba Chitra¹, Suchit S. Shetty², International Journal of Therapies and Rehabilitation Research [E-ISSN: 2278-0343] <http://www.scopemed.org/?jid=12> IJTRR 2015, 4: 4 I doi: 10.5455/ijtrr.-00000073
9. Position-specific deficit of joint position sense in ankles with chronic functional instability, Shigeki Yokoyama, Journal of Sports Science and Medicine (2008)7, 480-485.
10. Kisner, Carolyn. Therapeutic exercise : Foundations and Techniques / Carolyn Kisner, Lynn Allen Colby. — 5th ed.
11. Patricia A downie, cash's textbook of neurology for physiotherapists/ Patricia downie, Lippincott Williams and wilkins publications ---- 4th edition
12. The Role of Ankle Proprioception for Balance Control in relation to Sports Performance and Injury JiaHan, Judith Anson, Gordon Waddington, Roger Adams, and YuLiu Hindawi Publishing Corporation , BioMed Research International, Volume 2015, Article ID 842804, 8 pages <http://dx.doi.org/10.1155/2015/842804>