

Tactile Acuity and Pain Intensity on Chronic Low Back Pain Subjects: An Observational Study

Dr. Ramesh Natrayan, MPT (Neuro)*

Associate Professor, CU Shah Physiotherapy Collage, Surendra Nagar, Gujarat, India

Original Research Article

***Corresponding author**

Dr. Ramesh Natrayan

Article History

Received: 01.09.2018

Accepted: 05.09.2018

Published: 30.09.2018

DOI:

10.21276/sjams.2018.6.9.84



Abstract: Tactile acuity refers to the precision with which we can sense touch,¹ and this precision is thought to be impaired in some chronic pain conditions². Recent neuroscientific researches have suggested that chronic pain is accompanied by cortical reorganization and may serve an important function in the persistence of the pain experience. Discriminative ability is dependent on the integrity of primary somatosensory cortex; hence, in some chronically painful conditions, cortical reorganization appears to manifest as reduced tactile acuity at the affected body region. This cortical reorganization influences the cognitive and behavioural changes to the chronic pain sufferers. Two point discrimination is one of the measures to find out the cortical tactile acuity in the human body. The aim of this study to find out the deficits in tactile acuity related to pain intensity. To find out the relationship between the tactile acuity and the pain intensity on chronic low back pain patients. This is a cross-sectional investigation on the non-neuropathic chronic low back pain patients. SPSS Version 16 will be used for data analysis. A Spearman's correlation coefficient (r_s) was calculated to estimate the overall relationship between tactile acuity and the pain intensity. The significance value for Spearman's correlations of pain intensity with two point discrimination positively correlated ($r_s = 0.550$ and $p < 0.001$). In summary, the main findings described in this study suggested that decreased tactile acuity coincided with the pain intensity with chronic non-neuropathic back pain subjects.

Keywords: Tactile Acuity, Two Point Discrimination, Chronic Back Pain.

INTRODUCTION

The feeling we have of our own body, its contours and alignment in space, the fact that it is ours, constitutes a fundamental aspect of self-awareness [1]. This physical self-awareness, or body image, depends on internal body maps that are modulated by somatic and proprioceptive input. Although it is often taken for granted, body image is sometimes disrupted in people with pain disorders such as complex regional pain syndrome [2] and phantom limb pain [3].

The critical role of the brain in pain has been assumed for centuries,⁴ The changes that occur in the central nervous system (CNS) when pain persists have revealed an even more important role of the brain than expected. Indeed, when pain persists, reorganization in the brain may actually contribute to chronic pain [5].

The most common chronic painful condition is back pain. Patients with chronic back pain have reduced proprioceptive acuity at the back [6], have a cortical representation of the back that is markedly different to healthy controls [7] and, anecdotally, find subtle movements of their pelvis and back more difficult than

people without back pain do. It is not known, however, whether the conscious sense of the back is disrupted in people with chronic back pain.

Tactile acuity refers to the precision with which we can sense touch[8] and this precision is thought to be impaired in some chronic pain conditions[9] Discriminative ability is dependent on the integrity of primary somatosensory cortex [10]; hence, in some chronically painful conditions, cortical reorganization appears to manifest as reduced tactile acuity at the affected body region. This cortical reorganization influences the cognitive and behavioural changes to the chronic pain sufferers.

The maximum activity elicited in primary somatosensory cortex was shifted more medially in the very chronic back pain subjects. This suggested that chronic pain is accompanied by cortical reorganization and may serve an important function in the persistence of the pain experience [7].

The ability to discriminate 2 stimuli close in space, called spatial acuity is a fundamental function of

exteroceptive sensory systems. Two-point discrimination (TPD) has been used extensively in clinical practice to evaluate the severity of peripheral nerve injuries and monitor patient recovery and response to treatment [11, 12].

Weber first introduced TPD in 1853 and defined it as “the distance between compass points necessary to feel two contacts”[11]. Dellon, Mackinnon and Crosby [13] have reported the TPD tests have interobserver reliability. Moberg [14] also stated that valid and repeatable results of TPD test depend on exact protocol and proper tools.

While dependent on innervations density and intact neural pathways, tactile acuity is also dependent on response profiles of primary sensory cortex cells and the sensory neuraxis[15]. Two point discrimination is one of the measures to find out the cortical tactile acuity in the human body. The aim of this study to find out the deficits in tactile acuity related to pain intensity.

Objective of the study

To find out the relationship between the tactile acuity and the pain intensity on chronic low back pain patients.

MATERIALS AND METHODS

This is a cross-sectional investigation on the non-neuropathic chronic low back pain patients. In this study thirty two subjects were selected in convenience sampling method who fulfil the following inclusion criteria; 1)Age Group Between 20 To 60 Years, 2) Both Sexes Are Included, 3)Non-neuropathic Low Back Pain More Than 6 Months. The subjects were excluded if they had 1) Neuropathic low back pain, 2) Other musculoskeletal and neurological dysfunctions, 3) Subjects with Visual Impairment, hearing impairment,

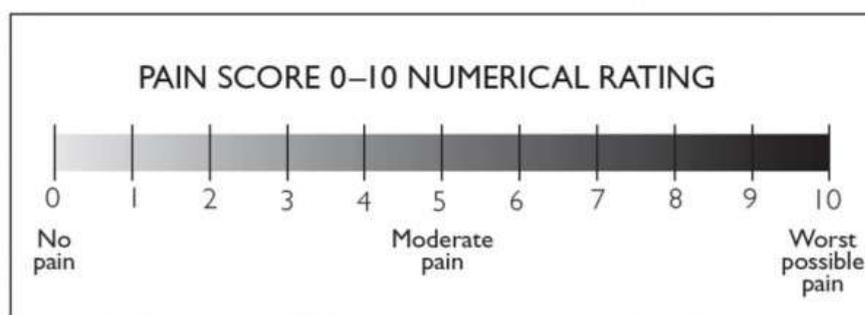
motor disorders or any other systemic illness. All the subjects gave written informed consent to participate in this study. Numerical pain rating scale (NPRS) was used to measure the pain intensity of the subjects and the two point discrimination threshold was measured by using the mechanical caliper over the painful area.

The aim of this study to identify the relationship between the pain intensity and two point discrimination thresholds on the chronic low back pain patients and this study also aimed to establish the cortical involvement on the chronic pain sufferers.

Test procedure

Those who were fulfilled the inclusion criteria positioned in prone lying with comfortable support in chest, pelvic and ankle regions. Painful area was marked and two point discrimination was assessed with mechanical caliper. The two-point test was performed using a simple with mechanical calliper having sharp-pointed tip. The interval between the two tips of this simple instrument was continuously adjustable and was measured in mm [16].

The Numeric Pain Rating Scale (NPRS) is a unidimensional measure of pain intensity in adults, including those with chronic pain [17]. The NPRS is a segmented numeric version of the visual analog scale (VAS) in which a respondent selects a whole number (0–10 integers) that best reflects the intensity of his/her pain. The common format is a horizontal bar or line. Similar to the VAS, the NPRS is anchored by terms describing pain severity extremes. The 11-point numeric scale ranges from '0' representing one pain extreme (e.g. “no pain”) to '10' representing the other pain extreme (e.g. “pain as bad as you can imagine” or “worst pain imaginable”)[17].



STATISTICAL ANALYSIS

SPSS Version 16 will be used for data analysis, under the guidance of expert statistician. Visual inspection and statistical test for normal distribution revealed that the two point discrimination data was not normally distributed. A Spearman’s correlation coefficient (rS) was calculated to estimate

the overall relationship between tactile acuity and the pain intensity.

RESULTS

32 subjects who fulfilled the inclusion criteria was selected and the demographical data for the subjects as follows;

Table-1: Demographic data

N	32
Age (mean)	40.43
Age (standard deviation)	±11.08
Male : Female ration	18:14
Mean(NPRS)	6.12(±1.69)
Mean(2PD)	17.84(±4.71)

A Spearman's correlation coefficient (r_s) was calculated to estimate the overall relationship between tactile acuity and the pain intensity. The significance value for spearman's correlations of pain intensity with two point discrimination positively correlated ($r_s = 0.550$ and $p < 0.001$).

DISCUSSION

This study aimed to establish the relationship between pain intensity with two point discrimination on chronic non neuropathic back pain subjects. The results of this study showed that there is a positive correlation between pain intensity with two point discrimination. Previous studies have shown that the chronic pain is significantly associated with reduced ability to identify temporal and spatial characteristics of tactile stimuli [7] some studies suggested that heightened pain sensitivity is a characteristic feature of several pain syndrome [18]. Moseley *et al.* conducted cross sectional investigation in a small group of patients with non-specific back pain, and a comparison group of healthy controls, demonstrates in patients, disrupted body image and decreased tactile acuity at the level and side of back pain [19] but there is previous evidence of distortion of body image from patients with CRPS [2] and phantom limb pain[3] and reduced proprioceptive acuity is well established in people with back pain[20].

One factor that seems relevant concerns cortical reorganisation: in CRPS, where the perceived size of the limb is enlarged, its representation in primary sensory cortex is smaller than that of the unaffected limb [21] and in phantom limb pain, the representation of the face invades that of the missing limb, as though the representation of the missing limb has got smaller. In contrast, in back pain, where the affected area feels smaller or as though it is 'missing', there is a different pattern of cortical reorganisation – the representation of the back is larger than it is in healthy controls [7]. Taken together, these data raise the possibility that S1 representation and perceived size of a body part are inversely related [19]. Increase in TPD or decrease in tactile acuity, coincided with the disruption of body image. TPD threshold depends on lateral inhibition provided by interneurons in S1, so a persistent decrease in TPD necessarily constitutes a shift in the response profile of S1 neurons, regardless of other influences [19].

So, the two point discrimination represents the cortical reorganisation, which altered by the intensity of

pain in chronic back pain subjects. There is a positive correlation between the NPRS with two point discrimination. This study will help us to change our perception on chronic pain subjects and the treatment aspects for the health care professionals.

CONCLUSION

In summary, the main findings described in this study suggested that decreased tactile acuity coincided with the pain intensity with chronic non-neuropathic back pain subjects.

Limitations

In this study, does not explain the age affects on TPD thresholds. And not compare the data with normal healthy individuals. This study conducted with small sample size and does not explain the other tactile sensory influence on cortical reorganization.

REFERENCES

1. James W. Principles of psychology, New York: Henry Holt. 1890, (1).
2. Moseley GL. Distorted body image in complex regional pain syndrome. *Neurology*. 2005 Sep 13;65(5):773-.
3. Flor H, Nikolajsen L, Jensen TS. Phantom limb pain: a case of maladaptive CNS plasticity?. *Nature Reviews Neuroscience*. 2006 Nov;7(11):873.
4. Descartes R. *L'homme*. Lion d'Or: Chez Charles Angot.1644.
5. Flor H, Elbert T, Knecht S, Wienbruch C, Pantev C, Birbaumer N, Larbig W, Taub E. Phantom-limb pain as a perceptual correlate of cortical reorganization following arm amputation. *Nature*. 1995 Jun; 375(6531):482.
6. Brumagne S, Cordo P, Verschuere S. Proprioceptive weighting changes in persons with low back pain and elderly persons during upright standing. *Neuroscience letters*. 2004 Aug 5; 366(1):63-6.
7. Flor H, Braun C, Elbert T, Birbaumer N. Extensive reorganization of primary somatosensory cortex in chronic back pain patients. *Neuroscience letters*. 1997 Mar 7; 224(1):5-8.
8. Goldstein EB, editor. *Encyclopedia of perception*. Sage; 2010.
9. Moseley GL, Flor H. Targeting cortical representations in the treatment of chronic pain: a review. *Neurorehabilitation and neural repair*. 2012 Jul;26(6):646-52.

10. Duncan RO, Boynton GM. Tactile hyperacuity thresholds correlate with finger maps in primary somatosensory cortex (S1). *Cereb Cortex.* 7:2878-2891, 2007.
11. Lundborg G, Rosen B. The two-point discrimination test: time for a re-appraisal? *J Hand Surg Am* 2004;29: 418_22.
12. Jerosch-Herold C. Assessment of sensibility after nerve injury and repair: a systematic review of evidence for validity, reliability and responsiveness of tests. *Journal of hand surgery.* 2005 Jun;30(3):252-64.
13. Dellon AL, Mackinnon SE, Crosby PM. Reliability of two-point discrimination measurements. *The Journal of hand surgery.* 1987 Sep 1;12(5):693-6.
14. Moberg E. Two-point discrimination test. A valuable part of hand surgical rehabilitation, eg in tetraplegia. *Scandinavian journal of rehabilitation medicine.* 1990;22(3):127-34.
15. Lotze M, Moseley GL. Role of distorted body image in pain. *Current rheumatology reports.* 2007 Dec 1;9(6):488-96.
16. Seng -yeun Won, Hye-Kyoung Kim. Two-point discrimination values vary depending on test site, sex and test modality in the orofacial region: a preliminary study. *J applied oral science.* 2017;25(4):427-35.
17. Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine.* 2005 Jun 1;30(11):1331-4.
18. Puta C, Schulz B, Schoeler S, Magerl W, Gabriel B, Gabriel HH, Miltner WH, Weiss T. Somatosensory abnormalities for painful and innocuous stimuli at the back and at a site distinct from the region of pain in chronic back pain patients. *PLoS One.* 2013 Mar 15;8(3):e58885.
19. Moseley GL. I can't find it! Distorted body image and tactile dysfunction in patients with chronic back pain. *Pain.* 2008 Nov 15;140(1):239-43.
20. Knost B, Flor H, Birbaumer N, Schugens MM. Learned maintenance of pain: muscle tension reduces central nervous system processing of painful stimulation in chronic and subchronic pain patients. *Psychophysiology.* 1999 Nov;36(6):755-64.
21. Maihofner C, Handwerker HO, Neundorfer B, Birklein F. Patterns of cortical reorganization in complex regional pain syndrome. *Neurology.* 2003;61:1707-15.