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Brief Report

Two-Point Discrimination Test in the Treatment of Right-handed Females with Lumbosacral Radiculopathy

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Abstract

Non-somatic causes of pain may aggravate painful complaints and complicate the conservative management of diseases such as lumbo-sacral disk root disease. The two-point discrimination test has been used for assessment of diseases, which change patients' skin sensation. This study aims to find out how applicable is two-point discrimination test in the conservative treatment of lumbo-sacral disk diseases. Twenty right-handed females suffering from unilateral lumbo-sacral disk disease were admitted for a conservative treatment from 2006 to 2009. The treatment consisted of a week bed rest, physiotherapy, and medication. They were subjected to straight leg raising tests, and their pains were evaluated using visual analog scale. The values of two-point discrimination test were obtained bilaterally for L_4, L_5 and S_1 dermatomes. Changes between the involved and intact lower limbs as well as values of two-point discrimination test before and after the treatment were also compared. In addition, the correlation between the outcome of two-point discrimination, straight leg raising tests, or pain scores were evaluated. There was a significant ($P<0.001$) difference between the changes in the values of two-point discrimination test, pain scales, or straight leg raising tests in the involved and intact limbs before and after the treatment. However, correlation among variables did not reach statistical significance ($P<0.94$, $r=0.017$). The results indicated that although two-point discrimination test is a feasible and objective tool to evaluate patients' improvements during the conservative management of lumbo-sacral disk diseases, there were no strong correlations between two-point discrimination test and straight leg raising tests, or pain scale.

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Keywords ● Sensitivity test ● lumbosacral ● radiculopathy

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Introduction

Nerve root compression in the lumbar disk syndrome is a common cause of acute, chronic and recurrent low back pain accompanied by radiating pain to the lower extremity superimposed by sensory motor impairment.[1] Most patients with disk-induced radiculopathy respond to conservative management. When radiculopathy occurs, several features including pain distribution, reflex changes, distribution of weakness and sensory alteration

provide reliable information to enable a clinician to localize the level of disk protrusion or root irritation.[1,2]

Pain management admittedly requires many initiatives within the disciplines of medicine, ethics and law; otherwise, unreasonable failure to treat pain may be viewed as medical malpractice. Pain management practitioners must meet the standards of care to avoid liability for malpractice.[3] As a result, physicians look for more objective and quantitative data than patients' pain complaint to estimate the severity of radiculopathy. There are some studies, which indicate that the two-point discrimination test is applicable for the assessment of various painful diseases associated with sensory-motor deficit.[4-7]

This study was designed to find out whether or not the changes in patients' skin sensation, seen in lumbo-sacral disk root pain, correlate with their disease condition during conservative treatment.

Materials and Methods

The study was conducted observing the ethical guidelines approved by the Ethics Committee, Jundishapur University of Medical Sciences, Ahvaz, Iran. The objective of the study was explained to the participants, and written informed consents were obtained.

This is a cross-sectional study recruiting 20 right-handed females, whose ages range was 40-58 years. Using simple random sampling, they were recruited from three community-based facilities in a period from April 2006 to January 2009. The subjects were selected based on their medical histories and physical examinations. Since it was expected that the treatment plan would improve their conditions, all of the patients agreed to participate in the study. All of the patients were diagnosed with lumbo-sacral radiculopathy through the physical examination, and approved by para-clinical studies.[1,2] They were hospitalized for a week of complete bed rest during the study. Furthermore, they received oral sodium diclofenac (Alborz Darou Co., Tehran, Iran); 25 mg four times-a-day, and oral prednisolone (Aburaihan, Tehran, Iran); five mg once daily for five consecutive days.[8,9]

Skin sensitivities and touch thresholds of the L_4, L_5 and S_1 dermatomes were measured and recorded by a BASELINE ^{R} plastic two-point discriminator instrument on the first day and on the seventh days of hospital admission. Based on segmental innervations, dermatomes with less innervations overlap were selected, and two-point discrimination tests were performed.[10]

The plastic pins typically minimize the influence of temperature on touch sensation. A minimal pressure of two pins was simultaneously applied while measuring the ability of each patient's two-point discrimination test values. In order to have more reliable control measurements, the same measurement method was performed to the unaffected lower limbs by the same examiner. The straight leg raising test (SLR) was performed for all the subjects bilaterally in supine position, and the positive or negative results were recorded.[11] Also, the patients' pain was individually quantified using a Visual Analog Scale upon arrival and on the seventh day of hospitalization. Any decrease in the reported pain scale was considered as an improvement of patient condition.[12] Moreover, the participants were re-examined for bone and joint pains, hip joint motion limitation, and visual acuity by the investigators six month after the hospitalization. The extent of improvement in both limbs was compared.

The nurse, who dealt with the pain scaling, was not aware of the results obtained by the physiotherapist involved in the two-point discrimination tests. The staff was not informed of the results of pain scaling as well. Moreover, the physicians were not aware of the results they obtained before finishing the hospitalization period.

Data are presented as mean±SD. They were analyzed using Statistical Package for Social Sciences (SPSS). Paired t, unpaired t, or Spearman's correlation tests were used for statistical analysis. A P value of ≤0.05 was considered statistically significant.

Results

The values (mean±SD) of two-point discrimination tests obtained from L_4, L_5 and S_1 dermatomes for the intact and involved limbs before and after the treatment are shown in table 1. The pretreatment values of two-point discrimination tests obtained from L_4 and L_5 in intact and involved limbs were significantly lower than those of after treatment values in the same limb. Moreover, the two-point discrimination tests values obtained after treatment from involved limb, but not that of intact limb, was significantly lower from that of pretreatment values (table 1).

The difference in the values of dermatomes from two-point discrimination tests before and after treatment in the intact and involved limbs were compared using unpaired t test. The changes in two-point discrimination tests

Table 1: The values (means±SD) of two-point discrimination tests (in millimeter) in different dermatomes before and after treatment in intact and involved limbs

	Intact limb			Involved limb		
	Before treatment	After treatment	P value	Before treatment	After treatment	P value
L_4	3.02±1.05	2.05±1.14	0.001	5.77±1.38	3.65±1.3	0.001
L_5	3.15±0.87	2.15±0.87	0.001	6.77±1.57	3.8±1.32	0.001
S_1	0.97±0.3	0.9±0.44	0.391	1.62±0.7	0.9±0.2	0.001

values were significantly higher in the involved limbs than those in the intact limbs (table 2).

The pain score for the patients on day 7 of hospitalization was 6.05±2.52, which significantly lower than that on day 1 (8.5±1.72).

In 16 out of 20 patients (80%), the results of SLR tests became negative after the treatment, while five out of 20 patients (20%) remained positive. This further indicated that the treatment schedule did manage to improve the patients' condition.

The Spearman's correlation tests did not reveal a significant correlation between the changes in the outcomes of two-point discrimination tests and changes in the pain scales at L_5 level (r=0.017, P=0.94) or S_1 level (r=-0.14, P=0.55). Likewise, the correlation between the changes in the results of two-point discrimination tests and changes in the outcomes of SLR changes was not significant.

Discussion

Admittedly, the improvement in skin sensitivity would lead to increase its ability to discriminate between the two sharp points. That is why by improving the skin sensitivity, the values of two-point discrimination tests tend to decrease.

The decreased skin sensitivity of the involved limbs along with the improvement in the values of two-point discrimination tests after the treatment, indicate that the lumbo-sacral disk root pain reduces skin sensitivity, which influences the two-point discrimination test.

The present study show that the improvement in the values of two-point discrimination tests in the involved limb was shown to be significantly greater than that in the intact limbs after the treatment. Also, a study on patients suffering from lumbo-sacral radiculopathies revealed that the values of two-point discrimination test did improve over the time after the injuries.[13] Moreover, the present study revealed a significant clinical association between the conservative treatment of the lumbo-sacral radiculopathy and the improvement of two-point discrimination of the involved limbs. However, lack of significant statistical correlation between the changes in two-point discrimination test with the patients' pain complains or SLR improvement remains obscure and requires further studies.

Although this study adopted a test, which used static and gentle discriminators pressure over the skin, it did not manage to standardize the exact pressure applied on the patients' skin. Moreover, it did not control the exact time, during which the discriminator pins were in contact with the patients' skin. Further, this study failed to separate exactly the dermatome innervations of the leg, which was due to dermatomal innervations overlap. Moreover, one should consider that the transmitting pathways which conduct painful stimuli to the brain are different from sensory afferents, which are functional in two-point discrimination test. The two different neuroanatomical pathways in the center may be a reason for the lack of statistical correlation in this study. Further, small sample size may be another cause for this lack of correlation, and studies with bigger sample size may lead to a more reliable answer. Besides, lumbo-sacral root pains may initiate a chronic spinal pain syndrome during which the processes of peripheral and central pain sensitization and the process of neuronal plasticity might occur.[13,14] This process may interfere with the outcome of two-point discrimination test, and requires another study to elucidate their relations.

Conclusion

The findings of this study confirmed that in right-handed females comparison of values of two-point discrimination tests from the involved and intact lower limbs as well as SLR test and scaling

Table 2: The mean±SD of differences (mm) of improvement of two-point discrimination tests in L_4, L_5 and S_1 dermatomes of the intact and the involved limbs before and after the treatment

Dermatome	Intact limb	Involved limb	P value
L4	0.97±0.25	2.12±1.09*	0.0001
L5	0.95±0.22	2.97±0.85*	0.0001
S1	0.07±0.38	0.72±0.76*	0.0001

* indicate significant improvement compared with that of the intact limbs.

of the patients' pain, is a manageable and practical method to assess and monitor the symptoms of unilateral lumbosacral radiculopathies.

Conflict of Interest: None declared

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