INTRODUCTION

The human spine acts as a multisegmental, flexible rod forming the central axis of neck and trunk. Normal bony spine forms three major curves on the sagittal plan which consist of 24 presacral vertebrae [1]. Lumbar muscles play a role in lumbar segmental stability and give a basic support which consists of global outer muscles and local deeper muscles [2]. The global (outer) muscle - rectus abdominal, oblique's, latissimus dorsi, and erector spinae. The local (deeper) muscle - transverse abdominis, multifid, and quadratus lumborum [3,4].

Around 80% of the population having low back pain at some point in their life which may be due to heavy physical workload, frequent lifting, extreme sports activities, frequent bending, and twisting [5]. Prevalence data from population-based studies conducted worldwide indicate a substantial variation in overall prevalence ranging from 10% to 25% in women and from 10% to 27% in men [6].

Pain is defined as low back pain with unknown specific pathology, e. g., infection, tumor, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome [7].

History of a non-specific low back is lifting and/or twisting while holding heavy object, operating a machine that vibrates, prolonged sitting, fall [8], coughing, sneezing, and straining [9].

Isometric exercise training (static exercise): Isometric (stability) exercises are a static form of exercise, in which muscle contracts and produces force without an appreciable change in the length of the muscle and without visible joint motion [10,11].

Isotonic exercise training (dynamic exercise): Isotonic exercises are a dynamic form of exercise, in which muscle contraction causes joint movement and excursion of a body segment as the muscle contracts and shortens (concentric muscle action) or lengthens under tension (eccentric muscle action) [12].

METHODS

It was a comparative study conducted in the physiotherapy department of Krishna Institute of Medical Sciences. Ethical permission was obtained from the Institutional Ethical Committee, Krishna Institute of Medical Sciences Deemed University, Karad. 40 patients were equally divided into 2 groups using simple random sampling with random allocation. Baseline treatment was given to both the groups which consisted transcutaneous electrical nerve stimulation (TENS) and hot moist pack (HMP). Group A was given isometric exercise and Group B was given isotonic exercise. Participants were selected according to inclusion and exclusion criteria. Written informed consent was taken, and the whole study was explained to them. A detailed musculoskeletal evaluation was done to screen the patients. Inclusion criteria were as follows: (1) Both male and female, (2) age group - 20-35 years, (3) patients willing to participate in exercise program, and (4) history of non-specific low back pain since 3 months.

Exclusion criteria were as follows: (1) Any back injury or pathology within the previous 6 months, (2) resistance training or any type of core muscle training within the past 6 months and history of back surgery, and (3) rheumatologic disorder and spine infection.

Group A: HMP, TENS, isometric (stability) exercise.

Group B: HMP, TENS, isotonic exercise.

Isometric (stability) exercise

- Cuff up: Supine lying, one leg straight, the other leg flexed at 90°, support lower back with hands, elbow on the floor, keep torso and neck in line, engage core in raising head, and shoulders slightly off the ground.
- Side bridge: Side lying, lie on side with knees bent and prop upper body up on elbow raise hips off the floor, and hold 10 seconds.
- Bird dog: Quadruped position, both hands are under the shoulder and knees are under the hips, opposing arms and legs raised off the floor separately.
Isotonic exercise
- Bent knee sit-up: Supine lying, hands by side, knee flexed 60°, heels flat on floor, head and upper back raise.
- Cross curl up: Supine lying, bent knee about 60°, feet flat on the floor, hands placed behind neck, one leg across the other, the participant raised their contralateral elbow to the opposite knee.
- Prone back extension: Prone lying, bodies cant levered over the end, lowered their upper body at 90° of table after feet were secured with a strap and return to starting position.

Post-intervention scoring was recorded on the last day of treatment in the form of pain on visual analog scale (VAS), functional disability on modified Oswestry disability index (MODI), and strength on endurance test.

**RESULTS**

**Outcome measures: VAS**

Table 1 shows intragroup analysis of VAS score revealed statistically considered extremely significant in pain postinterventionally for both the groups. This was done using Wilcoxon matched pairs t-test (Group A: p<0.0001 and Group B: p<0.0001). Table 2 shows intergroup analysis of VAS score was done using Mann–Whitney test. Pre-interventional analysis showed no significant difference between Group A and Group B (p=0.5769). Post-intervention analysis showed no significant difference between Group A and Group B (p=0.7525).

**Endurance test**

**Abdominal**

Table 3 shows intragroup statistical analysis revealed statistically extremely significant increase in abdominal endurance postinterventionally for both the groups. This was done using Wilcoxon matched pairs t-test (Group A: p<0.0001 and Group B: p<0.0001) (Table 3).

Table 4 shows intergroup analysis of abdominal endurance test was done using Mann–Whitney test. Pre-interventional analysis showed no significant difference between Group A and Group B (p=0.0363). Post-intervention analysis showed no significant difference between Group A and Group B (p=0.8468).

**Extensors**

Table 5 shows intragroup statistical revealed statistically extremely significant increase in extensor endurance postinterventionally for both the groups. This was done using Wilcoxon matched pairs t-test (Group A: p<0.0001 and Group B: p<0.0001).

Table 6 shows intergroup analysis of extensor endurance test was done using Mann–Whitney test. Pre-interventional analysis showed no significant difference between Group A and Group B (p=0.8475). Post-intervention analysis showed significant difference between Group A and Group B (p=0.0363).

**Side support**

Table 7 shows intragroup statistical analysis revealed statistically extremely significant increase in side support endurance postinterventionally for both the groups. This was done using Wilcoxon matched pairs t-test (Group A: p<0.0001 and Group B: p<0.0001).

Table 8 shows intergroup analysis of side support endurance test was done using Mann–Whitney test. Pre-interventional analysis showed no significant difference between Group A and Group B (p=0.2762). The post-intervention analysis also showed no significant difference between Group A and Group B (p=0.3848).

**MODI**

Table 9 shows intragroup analysis of MODI score revealed statistically extremely significant in disability postinterventionally for both the groups. This was done using Wilcoxon matched pairs t-test (Group A: p<0.0001 and Group B: p<0.0001).

(7) Table 10 SHOWS intergroup analysis of MODI was done using Mann–Whitney test. Pre-interventional analysis showed no significant difference between Group A and Group B (p=0.5956).
difference between Group A and Group B (p=0.0186). Post-intervention analysis also showed no significant difference between Group A and Group B (p=0.1589).

**DISCUSSION**

The purpose of this study was to compare the effect of isometric and isotonic exercise training on core muscle in patients with non-specific low back pain.

Stranjals et al. reported in his study that low back pain is more common in females [13]. In this study, the total number of participants included was 40, of which 8 were males and 32 were females. Group A contained 3 males and 17 females whereas Group B contained 5 males and 15 females.

TENS works on the principle of Pain Gate Theory which was explained by Melzack and Wall in 1965 [14]. Noxious impulses are influenced by “gating mechanism.” Large diameter fibers inhibit the transmission of pain, thus “closing the gate” and when small fibers are stimulated, the gate is opened. When the gate is open, pain signals excite the dorsal horn transmission cell, and when the gate is closed, it does not excite the dorsal horn transmission neurons. The gating mechanism is influenced by nerve impulses that descend from the brain [14].

Superficial heating modalities usually do not heat deep tissue, including muscles, because there is a subcutaneous layer of fat beneath the skin which acts as thermal insulator and also inhibits heat transfer [15,16].

Isometric (stability) exercise training is a static form of exercise, in which a muscle contracts and produces force without an appreciable change in the length of muscle without visible joint motion [11,12]. Park et al. indicated that an exercise program that simultaneously strengthens the deep abdominal muscles and muscles of trunk is an ideal method for maintaining spinal stability physical balance [17].

In isotonic exercises, when a body segment moves through its available range, the tension that the muscle is capable of generating varies through the range as a muscle shortens or lengthens which is due to changing length, tension relationship of the muscle and the changing load [13-15]. Hence, the isotonic exercise helps in relieving pain and improving strength by both of these mechanisms. Laird et al. and Byström et al. concluded that core stability exercises are more effective in reducing pain and long-term compared to no treatment or general exercise in patients with non-specific low back pain [18,19].

Comparison of pain, strength, and disability between two groups was done using Mann-Whitney test to find effectiveness between two groups.

The statistical analysis revealed that there was no significant difference in pain, abdominal strength, lateral flexors, and disability in both groups. Both the groups were equally efficient to reduce pain (p<0.0001), disability (p<0.0001), and improve strength of abdominal and lateral flexors (p<0.0001). The intragroup evaluation revealed that there was significant difference in improving strength of extensors. Group A was more efficient in improving strength of extensors (p<0.0363).

The result from the statistical analysis of the present study supported null hypothesis which stated that there will be no significant difference in isometric (stability) and isotonic exercise training in core muscle in patient with non-specific low back pain for all other outcome measures except extensors.

Thus, it can be stated from above study that isometric (stability) and isotonic exercises along with HMP and TENS are most efficacious and cost effective.

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**CONCLUSION**

In conclusion, in the present study, there is no significant different between effect of isometric (stability) and isotonic exercise training except extensor endurance test which shows a significant difference in Group A.
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REFERENCES