Effect of Back Extension Exercise on Quality of Life & Back Extensor Strength of Women with Osteoporosis

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Abstract

The purpose of the study was to observe the effect of back extension exercise on quality of life and back extensor strength of women with osteoporosis. A sample of 30 subjects in the age group of 45 to 60 years were assessed and selected on the basis of inclusion and exclusion criteria. After obtaining their consents, the subjects were randomly allocated in the Experimental Group-A and the Control Group-B. Group A was given moist heat pack and back strengthening exercise and Group B was given hot pack and isometric exercise 1 set (10 repetitions) a day, 5 days a week for 4 weeks. The independent variables were back extension exercise and isometric exercise. The dependent variables were quality of life and back extensor strength. It is concluded that both the back extension exercise and back isometric exercise are effective in increasing back extensor strength and improving quality of life; however results suggest that back extension exercise is more effective than back isometric exercise in increasing back extensor strength and improving quality of life in post menopausal osteoporotic female patients.

Key words: Osteoporosis, Strength, Oswestry Disability Index.

Introduction

Osteoporosis is a disorder generally affecting the biomechanical competence of bone leading to an increased risk of fractures. It is a skeletal disorder characterised by a reduction in bone mass with accompanying micro architectural damage that increases bone fragility and risk of fracture *(Bijvojet et al., 1989)*. The primary osteoporosis refers to the condition when it occurs in the aging population when a secondary predisposing condition cannot be found. Thus, the primary condition includes both postmenopausal osteoporosis and osteoporosis of aging. The clinical hallmark of the disease is fracture, which most characteristically occurs in the spine, femoral neck, or distal radius, although it may occur in the pelvis, humerus, or any other bone and is associated with minimal trauma. As bone mass declines with menopause and age, fracture frequency also increases with age *(Hui et al., 1988; Riggs & Melton 1986)*. Osteoporotic fractures are most common in postmenopausal women and in elderly persons of both sexes and typically occur with moderate trauma. Bone mass is the major determinant of fracture risk with bone strength being 80-90% dependent on bone mass. Several studies in young adults show a correlation between bone mineral density and physical activity level, suggesting that exercise might increase peak bone mass *(Aloia et al., 1988; Kanders et al., 1988).* Along the same lines, immobilization or reduction in weight-bearing physical activity is well known to reduce bone mass, as demonstrated in paraplegia, poliomyelitis, space flight and bed rest for unrelated conditions *(Steinberg 1980).* In women, the rate of bone loss accelerates for several years before actual menopuause (during partial ovarian failure), and for as long as 10 years after complete cessation of ovarian function *(Mazees, 1982; Riggs et al., 1981).* The majority of evidence supports the importance of estrogen deficiency at menopause as the major factor in rapid bone loss and subsequent osteoporotic fractures *(Lindsay, 1988; Nilas & Christiansen, 1987).* Its pathophysiological basis includes a genetic predisposition to low peak bone mass and subtle alterations in bone remodelling due to changes in systemic and local hormones, coupled with environmental influences. The loss of estrogen at menopause increases the activation rate of more bone remodelling sites. Because resorption slightly exceeds formation in remodelling units, this elevated activation rate causes a net increase in skeletal resorption and hence bones loss, particularly on the endosteal surface of cortical bone and in cancellous bone. In addition, estrogen withdrawal may result in actual eradication of some trabecular units, this being caused by increased size or depth of resorption cavities *(Parlitt, 1987).* The pathogenesis of osteoporosis reflects the complex interplay among genetic, metabolic, and environmental factors that determine bone growth, peak bone mass, calcium homeostasis and bone loss. These factors are influenced by aging, physical inactivity, sex hormone deficiency, nutritional status. From the fourth decade onward, there is a remodelling imbalance at individual foci such that less bone is formed than is resorbed in most modelling units. This may be caused by impaired regulation of the osteoblast population rather than by intrinsic cellular osteoblast dysfunction. Back extensor strength has been of considerable importance in patients with osteoporosis. Osteoporotic women had significantly lower back extensor strength than healthy women. Back extensor strength was the most significant contributor to the spinal mobility, which had a strong effect on quality of life on patients with osteoporosis. Therefore, strengthening exercises for back extensors are recommended in management of patients with osteoporosis. While the cause of low back pain is multifactorial, many authors have suggested that osteoporosis can result in back pain in post menopausal women. Studies have been conducted to see correlation between muscle strength and bone mineral density of vertebral bodies. These studies demonstrate a positive correlation of the bone density and strength of back extensors. In 1982, it was reported that the combination of a few exercises with avoidance of flexion can safely and effectively strengthen the fragile osteoporotic spine. Chow's group randomized post-menopausal women to participate in aerobic, aerobic plus strengthening, or no exercise three times per week for 1 year and found significantly increased bone mass in the exercising groups, as compared with those who did not exercise *(Chow et al., 1987).* Bone mineral density of lumbar vertebrae was found to correlate significantly with the strength of back extensor muscles *(Sinaki et al., 1986).* Back extensor strength is the most significant contributor to the spinal mobility, which has a strong effect on quality of life in patients with osteoporosis.

Materials & Methods

A sample of 30 subjects in the age group of 45 to 60 years were assessed and selected on the basis of inclusion and exclusion criteria i.e. osteoporotic females diagnosed by physician as per diagnostic criteria, chronic back pain and their back strength with baseline measurement of 30 kg. After obtaining their consents, the subjects were randomly allocated in the Experimental Group-A and the Control Group-B. Group A was given moist heat pack and back strengthening exercise (Back extension exercise in a prone position with a pillow under the abdomen) 1 set (10 repetitions) a day, 5 days a week for 4 weeks. Group B was given hot pack and isometric exercise 1 set (10 repetitions) a day, 5 days a week for 4 weeks. The independent variables were back extension exercise and isometric exercise. The dependent variables were quality of life and back extensor strength. The outcomes were measured with back strength dynamometer for measuring back extensor strength and Oswestry Disability Index Questionnaire gives a percentage score that indicates each patient's level of functional disability.

The data was analysed using SPSS 17 software package. Statistical analysis for the two groups was performed to find out the mean, standard deviation and the statistical significance between ODI and dynamometer in both the groups. A paired t- test was used to compare the within groups values of ODI and dynamometer and unpaired t - test was used for between group comparison of ODI and dynamometer. The results were rated to be significant at $p < 0.05$.

Results & Discussion

The mean age of Group-A was 51.53 years with standard deviation of 3.543 and that of Group-B was 52.00 years with standard deviation of 3.485. The difference in the mean age of two groups was not statistically significant (t=2.05, p=0.178) (Table 1).

Table 1: Comparison of age between Group A & Group B

GROUP	MEAN± SD	T - VALUE	P - VALUE P<0.05	RESULT
A	51.53 ± 3.54	2.05	0.718	Non-significant
B	52.00 ± 3.48			

Table 2 shows the baseline comparison of Mean±SD scores of ODI and back strength between group-A and group-B. It was found that there was not statistical significant difference in pre-treatment scores of ODI and Back strength between different groups (Table 2).

Table 2: Baseline comparison of Mean± SD scores for ODI and Back strength between Group-A & Group-B

Group	A	B
ODI	34.27± 4.65	31.25± 4.10
Back Strength	32.67± 3.71	34.0± 4.70

ODI – Oswestry Disability Index

Within Group Comparison- the mean range of Oswestry Disability Index questionnaire (ODI) and Back strength scores of Group-A and B were taken at day 0 (before treatment) and after 4 - weeks of intervention. Paired t- test was used to compare the data within the group.

Table 3: Comparison of Mean ± S.D of ODI and Back strength within Group -A

Variable	Pre-treatment	Post-treatment	t-value	p- value (< 0.05)
ODI	34.27± 4.65	32.27± 7.04	2.14	significant
Back strength	32.67± 3.71	34.00± 3.38	2.14	significant

Table 3 shows that there was no significant difference in the pre treatment scores of ODI and Back strength in Group-A. But a paired-t test analysis revealed that there was statistically significant improvement in post-treatment scores of ODI ($t=2.14$, $p<0.05$) and Back strength ($t=2.14$, $p<0.05$) (Table 3).

Table 4 shows that there was no significant difference in the pre treatment scores of ODI and Back strength in Group-B. But a paired-t test analysis revealed that that there was statistically significant improvement in post treatment scores of ODI ($t=2.14$, $p<0.05$) and Back strength ($t=2.14$, $p<0.05$).

Table 4: Comparison of Mean ± S.D of ODI and Back strength within Group-B

Variable	Pre-treatment	Post-treatment	t - value	p- value (< 0.05)
ODI	31.25± 4.10	24.80± 8.40	2.14	significant
Back strength	34.00± 4.70	38.33± 5.20	2.14	significant

The difference in the mean values of scores of ODI and back strength between group-A and group-B was calculated by using unpaired t-test. Results of inferential statistical analysis revealed that there was statistically significant difference between post scores of QOL and Back strength in both groups. Further, it was found that group-B was showing more improvement in the mean scores of ODI ($t=2.05$, $p<0.05$) and back strength ($t=2.05$, $p<0.05$) than group-A at p-value < 0.05. Thus, the result of this study shows that there was an increase in back strength scores in both groups but the back extensor exercise group (Group-B) showed a statistical significant difference in outcome measures as compared to isometric exercise program (Group-A) (Table 5).

Table 5: Comparison of Mean± SD of ODI and Back strength between Group-A & Group-B

Variables	Group A	Group B	t-value	p- value (< 0.05)
ODI	2.00± 2.619	7.07 ± 7.005	2.05	significant
Back strength	1.33± 2.289	4.33± 4.952	2.05	significant

Discussion

The main objective of the present study was to see the effects of back extension exercise. The results of the present study showed that there was significant improvement in pre-test scores of quality of life and back extensor strength in back extension exercise group than isometric exercise group respectively. Some exercise programmes often called back extension exercises are designed to enhance trunk performance through the training of long trunk muscles (erector spinae and rectus abdominis), whose primary function is to generate movement. In chronic low back postmenopausal osteoporotic patients the effect of extension exercises show increase in strength of erector muscles of spine. However for postmenopausal osteoporotic patients it is difficult to perform many exercises. The mechanism, how back extension exercise training affects back pain and disability has been gained from another randomised clinical trial which examined the effect of backward bending of lumbar spine on intervertebral disc. The subjects were given moderate lumbar flexion and four degrees of lumbar extension exercise and found that posterior annulus can be stress shielded by the neural arch in extended postures and this may explain why extension exercise decrease back pain in some patients. However, a study done by *Dettori et al (1995)* investigated the effects of spinal flexion and extension exercises and their associated postures in patients with acute low back pain. The results concluded that flexion and extension exercises groups did not differ in any outcome over 8-weeks. Another study on relative effectiveness of an extension programme and a combined programme of manipulation and flexion and extension exercises in patients with acute low back syndrome and concluded that extension/mobilization followed by both flexion and extension results in more rapid resolution of symptoms and improvement in functional limitations than an established extension programme alone. The present study is support the findings of *David et al (2007)* reported the effectiveness of an extension oriented treatment approach in a subgroup of subjects with low back pain and the results concluded that subjects who received an extension oriented treatment experienced significantly greater improvements in disability than subjects who received an alternative trunk strengthening that both spinal flexion and extension exercises provided significant reduction programme at one week. In the present study back extension exercise was effective in improving back extensor strength and quality of life in post menopausal osteoporotic females; however back isometric exercise group also showed improvement in back extensor strength and quality of life in post menopausal osteoporotic females but not as significant as back extension exercise group.

Conclusion: It is concluded that both the back extension exercise and back isometric exercise are effective in increasing back extensor strength and improving quality of life; however results suggest that back extension exercise is more effective than back isometric exercise in increasing back extensor strength and improving quality of life in post menopausal osteoporotic female patients.

References

Aloia, J.E., Vaswani, A.N. and Yeh, J.K. 1988. Premenopausal bone mass is related to physical activity. *Arch. Intern. Med.* **148:** 121-123.

Bijvojet, O.L.M., Vellenga, C.J.L.R. and Harnick, H.I.J. 1989. Paget’s d/s of bones: Assess, therapy and sec. Prev. **In:** M. Kleerekoper, S. M. Krane (eds), *Clinical disorders of bone and mineral metabolism. New York*: Mary Ann Libert 525-542.

Chow, R., Harrison, J.E. and Notarius, C. 1987. Effect of two randomized exercise programmes on bone mass of healthy postmenopausal women. *Br. Med. J.* **295:** 1441-1444.

Browder, D.A., Childs, J.D., Cleland, J.A. and Fritz, J.M. 2007. Effectiveness of an Extension-Oriented Treatment Approach in a Subgroup of Subjects with Low Back Pain: A Randomized Clinical Trial, *Physical Therapy* December 2007 **vol. 87** no. 12 1608-1618.

Dettori, J.R., Bullock, S.H., Sutlive, T.G., Franklin, R.J. and Patience, T. 1995. The effects of spinal flexion and extension exercises and their associated postures in patients with acute low back pain. *Spine,* **20:** 2303–12.

Hui, S.L., Slemenda, C.W., Johnston, C.C. Jr. 1988. Age and bone mass as predictors of fracture in a prospective study. *J. Clin. Invest*. **81:** 1804-1809.

Kanders, B., Dempster, D.W. and Lindsay, R. 1988. Interaction of calcium nutrition and physical activity on bone mass in young women. *J. Bone Miner. Res.* **3:** 145-149.

Lindsay R. 1988. Sex steroids in pathogenesis and prevention of osteoporosis. In: B.L. Riggs., L.J. Melton (eds), Osteoporosis: Etiology, Diagnosis and Management. *New York: Raven Press*, 333-358.

Mazees, R.B. 1982. On aging bone loss. *Clin. Orthop.* **165:** 239-252.

Nilas, L. and Christiansen, C. 1987. Bone mass and its relationship to age and the menopause. *J. Clin. Endocrinol. Metab.*, **65:** 697-702.

Parlitt A.M. 1987. Trabecular bone architecture in the pathogenesis and prevention of fracture. *Am. J. Med.* 82: 68-72.

Riggs, B. L. and Melton, L.J. 1986. Involutional osteoporosis. *N. Eng. I. J. Med.* **314:** 1676-1686.

Riggs, B.L., Walmer, H.W., Dunn, W.L. 1981. Differential changes in bone mineral density of the appendicular and axial skeleton with aging: Relationship to spinal osteoporosis. *J. Clin. Invest* **67:** 328-335.

Sinaki, M., McPhee, M.C., Hodgson, S.F. 1986. Relationship between bone mineral density of spine and strength of back extensor in healthy postmenopausal women. *Mayo Clinproc.* **61:** 116-122.

Steinberg, F.U. 1980. The effects of immobilization on bone. In: FU Steinberg (ed), The Immobilized patient: Functional Pathology and Mangement. *New York: plenum* 33-64.