

SHORT COMMUNICATION

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OSTEOPOROSIS: PHYSIOTHERAPY ROLE IN MANAGEMENT AND PREVENTION

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ABSTRACT

Background: Osteoporosis is a metabolic bone disease that progress silently leading to loss of bone mass. The fractures caused because of osteoporotic bones are widely prevalent in India and are one of the common causes of morbidity and mortality in elderly population. The Health care providers and Physiotherapist have a specific role in osteoporosis through exercise prescription, education and strategies to maximize function, reduce the risk of falls and manage pain. There are various treatment protocols involved treatment and prevention of osteoporosis, among which the exercises have an impact on the bone mineral density. The studies have presented the importance of exercises in improving the bone mass apart from improving function and reducing the risk of fractures. The various type and intensity of exercises vary with age and it is important to understand the benefits and adverse effects. There are few studies emphasizing on the regimes and type and intensity of exercises. This manuscript provides an overview of physiotherapy management for bone health with an emphasis on the clinical recommendations and exercise prescription. The effects of exercise and its evidence in prevention and treatment of osteoporosis are also discussed.

Methods: The article was framed with the Data sourced from electronic database, systematic reviews, meta-analyses from pub med, Medline, science direct and Cochrane library.

Result: Early intervention and exercise has a positive correlation against BMD and bone health.

Conclusion: Various exercises have their benefits in osteoporosis and a combination of exercises must be recommended based on a methodical assessment.

Keywords: Osteoporosis, exercises, physiotherapy, bone mass density, Bone mass density, management. (Included Boolean operators “and”, “in”)

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INTRODUCTION

Osteoporosis is a serious health and an increasing community health crisis that causes decreased quality of life in the afflicted. Prolonged periods of inactivity and bed rest can increase the risk of developing osteoporosis, the diet and life style adds to the reduced bone mass. The mechanical loading through physical activity and exercises increases the bone mass. The physical activity as a way to prevention is based on the evidence in which the formation and accumulation of minerals takes place by the regulation of the bone cells. In addition, the exercises and physical activity increases the strength of muscles, improves balance, reduce the risk of falls and fractures. Preventive approach against the osteoporosis development includes maximizing the bone mass in early life and slowing bone loss due to the age-related loss. Approaches to improve bone strength and reduce the possibility of falls are the important factors in prevention of the complications in osteoporosis.

Physiotherapists play a very important role in managing osteoporosis enabling through assessment, exercise prescription, therapeutic modalities, special techniques and education. Appropriate goals are established through thorough assessment of signs and symptoms, involving the risk factors and functional status of the afflicted. The main aim is to maximize peak bone mass during the phases of childhood to adolescence and in adult and elderly is to increase and conserve bone mass, reduce the risks, reduce pain and improve mobility, balance and posture. Intervention of exercises has established that physical activity and exercises can reverse or prevent the loss of bone [1]. These are achieved through appropriate planning and implementing structured physiotherapy training programmes for the population.

CURRENT PRACTICE:

Improving Physical activity and encouraging Active Lifestyle

Bone Mass Density (BMD) in physically active at all aged people is by and large higher than the sedentary. Activities like walking, jogging, running [2] and functional movements help to maintain the mobility and decrease chances of bone loss. There are greater benefits of exercise intervention in elderly through emphasis on active lifestyle; this has been demonstrated by controlled studies in reversing the loss of bone. Observational studies have stated that there is an association between the bone density and physical activity at various age and duration. A child who has been active and involved in physical activities tend to have a higher BMD compared to a less active childhood.[3] Similarly currently physically active and lifetime physically active individuals have demonstrated a higher bone strength [3,4]. An active physical occupation has also been shown to be an important factor in the prevention of osteoporosis [5]. Cooper and colleagues found individuals of physically active for more than five hours a week had a significant reduced risk of hip fracture [6]. The risk of bone loss in adult and elderly may be reduced by involving in active physical

work and by active participation in the Activities of Daily Living (ADL) and physically active work field will reduce the risk of major bone loss in the adult and elderly.

Weight loading exercises and High-impact exercises

One of the primary functions of the human skeleton is to bear load, the bone has the property of adapting itself by increasing its mass density to the various changes in the functional loading. Weight-bearing exercises are most effective in maintaining and increasing the bone mass. The weight bearing exercises like running, jogging, walking, dancing, climbing stairs has much greater effect in increasing the bone mass. The muscle forces and gravity has an effect by producing stress on the joint and bones by which the osteoblast activity is stimulated. Literatures have demonstrated the most bone gain is achieved by the weight bearing exercises [7,8].

Strength training augments to the amount of muscle forces which are exerted on the skeleton. The forces produced by the muscle contraction and by the ground reaction forces during weight bearing have a component of loading the skeleton system. It is well recognized that Bone has the ability to adapt to the imposed load [9,10]. The strength training in addition maintains and enhances the BMD; it also improves balance and thus may prevent falls. Literatures have shown that bone mineral content increased due to an increase in the muscle strength, which is achieved by exercises and resistance training. The dynamic strength exercises and isometric activity can be incorporated in the functional training. The functional training especially in elderly has a greater efficacy to improve the bone strength. The low impact exercises have a significant improvement in the bone mass and have a greater role in people with osteoporosis.

Activities that improve coordination, balance and posture

Osteoporosis can lead to person acquiring various deformities and postural abnormalities. The destabilizing forces acting away from the joint leading to imbalance are evident in person with kyphosis deformity. An altered external force away from joint requires an increased muscle force to maintain stability, especially an elderly adult with decreased muscle strength and neuro muscular coordination can have balance problems during their ADLs. Functional strengthening exercises, dynamic stabilization exercise for the trunk and extremities and postural re-education are particularly essential to normalize the mechanical forces. Various forms of exercises are modulated to the need; some form includes co-ordination exercises, exercise to improve balance through wobble or balance board, Physio Ball, trampoline, foam and Dura disk. There is adequate evidence to suggest a broad exercise regime which may aim to improve coordination, balance and posture. Resistance exercises, balance training, weight transfers, walking and use of assistive device can be incorporated as a multifaceted programme to deal with the risk factors of fall [11].

Controlled multi factorial exercise training program in-

cludes a combinations of functional and static exercises. Coalescing activities like aerobics, running, skipping, dynamic strength training, isometric - co contraction exercises, dancing may be employed in young adults and sports men. High impact sports activities like jumping, running, squash, tennis have an effect in increasing the BMD compared to the low impact sports activities like swimming [12]. Population and intervention studies suggests that the high impact activities are superior in increasing the BMD than the low impact activities, but low impact activities can help to prevent further loss [13]. Low impact exercises according to Robinson RJ et al, the core programme exercises include “box step, heel presses, step-step-kick-step-step-back, abdominal exercises, upper body twists, cross steps, knee lift triangles, leg press, rowing exercise, bent side leg raise, bent leg raise, front leg tucks, and side leg presses”[14]. Moderate aerobic exercise (low impact) - Protects against further bone loss and vigorous aerobic exercise (high impact) – helps to increase BMD [15].

Maximizing the peak bone mass will be one of the aim in children and adolescents. As a part of school programme and in physical education curriculum an assortment of weight bearing, high impact activities should be encouraged. These can be included as a part of the sport and play. In the adult of premenopausal age, structured exercises to load the bone must be encouraged, these may include high impact activities and weight training, and each has to be planned with proper evaluation and to their fitness needs. In the older adult group, a range of exercise programme are required to target the relevant spine, hip, knee and forearm areas, these are carried out clinically and with complete evaluation. The elderly population where there are more chances of fall risk, the risk factors are identifies and the plan should be directed towards the minimizing and reducing the risk of falls and suitable programme to improve balance should be incorporated. As high impact exercises in older adult especially with osteoporosis may be injurious, a progressive weight training and low impact exercises are appropriately administered. Postural correction and balance training may be effective along with assistive device to improve their confidence. Few activities for improved posture and balance may include functional exercises, fast controlled walking, balance board exercises, swimming and Otago exercises. Self management and home exercises programmes are facilitated to optimize function and to provide education.

CURRENT EVIDENCE

- An evidence level 1+ to maintain bone density in men and post menopausal women suggests a combination of low impact weight bearing exercises and high intensity strength training [16,17].
- To maintain BMD in post menopausal women regular high intensity resistance training should be incorporated with 60-70% of 1 RM (Repetitive maximum), 2-3 times per week.
- An evidence level 1+ suggests that the risk of falls in elderly population can be reduced by regular physical

exercises. Appropriate use of assistive devices and exercises emphasizing on balance training and gait have come out as an important components of exercises prescription among the community older population [18].

- Walking can result in favorable BMD changes - Asikainen et al 2004. A noted BMD change can occur with 40-70% VO2 max of aerobic activities for up to 50 weeks.
- A versatile resistance training of various types aiming at body structures at around 40-80% of 1 RM of 10 -15 repetitions, 3 days per week for 1 year increases BMD.
- Endurance activities and aerobic weight bearing activity has an effect on spine BMD. Walking with emphasis on proper weight transfers to spine and hip can be more beneficial and specific in enhancing the bone strength.
- In patients with post menopausal osteoporosis the Pilates exercises may be effective and safe in improving the quality of life [19].
- Nelson et al, 1991 has suggested that walking with weighted belt along with intake of calcium has shown to increase the BMD of the spine.
- The weight bearing and resistance exercises including walking, circuit training, theraband, physio ball exercises, balance and stretching exercises Weight bearing and resistance along with a hormone therapy has shown to increase the BMD in spine and hip.
- When compared with sedentary occupations, a manual labor has shown to reduce the rates of bone loss. A physically active occupation is thus encouraged to prevent the bone loss.
- Progressive resistance strength training for lower limbs, aiming at the hip and a combination of exercises for the spine may be incorporated in non weight bearing exercises [20].
- The exercise has the probable to be effective and safe to avert bone loss when used with appropriate evaluation and plan.
- The high impact exercises especially that produce ground reaction forces greater than two time body weight are considered to be more osteogenic than the low impact exercise. These exercises increases bone porosity and mechanically offset the thinning of bones thus diminish the risk of fractures.
- A combination of exercises has proved to be effective in reducing the bone loss when compared with the individuals who did no exercise, also people who exercised had a less chance of bone loss when compared to who didn't exercise.

CLINICAL PEARLS

- A well planned and structured, combination of exercise is recommended for people with osteoporosis.
- Strength training increases and improves the preservation of Bone mineral density - People who exercised by strength training had less bone loss than those who did not.

- A chance of having a fracture is reduced by regular exercise.
- As a part of osteoporosis management plan a high intensity training programme is recommended.
- The low impact weight bearing exercises are recommended in the elderly and in the post menopausal women with osteoporosis with a risk of fracture. The individuals with high risk of fracture especially spine fracture due to osteoporosis need to be administered with a modified exercise program with a thorough evaluation and goal setting.
- The exercise programme or plan should always begin at a low level which is contended to the individual and must progress with impact and intensity in requisites of their strength and fitness.
- Improving function, activities of daily living and preventing falls must be focused with the exercises directed distinctively loading the bone in the elderly population.
- There are possibilities of increased risk of fractures if the exercises are not done correctly, thus suitable monitoring and education is vital as a part of programme. The exercise programmes are preferably tailored based on the fitness factors and age.
- High impact loading, hasty or explosive movements, trunk repetitive flexion and twisting movements, dynamic abdominal exercises must be avoided in osteoporotic persons.

CONCLUSION

Physiotherapy by means of exercise management has an important role in osteoporosis. Exercises maintains and improves the Bone Mineral Density at all ages, a well planned programme can prevent the bone loss and thus reduce the risk of osteoporosis. An effective exercises program in children and young adults emphasizing on high impact and resistance exercises can maximize the bone formation and strength. Exercises have to be modified, programmes tailor made and administered to older adults and people with osteoporosis, various forms of exercises to improve balance and posture must be included. An evaluation on function and fitness activity level must be a foundation for the physiotherapy management in treatment of osteoporosis. Management of osteoporosis by exercises must be well planned and aimed at different age and gender, when combined with diet and calcium supplements have shown to have a better outcome.

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