

Enhancing Bone Health in Adult Spinal Deformity Patients: An Overview

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Introduction

Adult spinal deformity is a condition characterized by abnormal curvature or misalignment of the spine in older individuals, leading to pain, functional impairment, and reduced quality of life. These deformities are often a result of degenerative processes such as osteoarthritis, osteoporosis, and disc degeneration, which weaken the structural integrity of the spine. In addition to spinal misalignment, poor bone health is a critical issue in ASD patients, as it can exacerbate deformities, increase the risk of fractures, and complicate surgical treatment. Optimizing bone health is a crucial aspect of managing ASD, particularly in the context of both non-surgical and surgical interventions. This article provides a comprehensive overview of strategies to enhance bone health in adult spinal deformity patients, focusing on the role of nutrition, physical activity, pharmacological treatments, and surgical techniques to promote bone strength, stability, and overall spinal health. Bone health plays a critical role in the progression and treatment outcomes of ASD. Osteopenia (low bone density) and osteoporosis (severe bone loss) are common in ASD patients, as these conditions are strongly associated with aging.

Compromised bone health not only accelerates the degenerative processes that lead to spinal deformity but also increases the risk of vertebral fractures, further exacerbating spinal instability. Calcium is a primary component of bone, and adequate intake is necessary to maintain bone density and prevent osteoporosis. In ASD patients, ensuring sufficient calcium intake is critical for both bone health and postoperative recovery in those undergoing surgery. Vitamin D is equally important, as it facilitates calcium absorption from the gut and regulates calcium levels in the blood. Deficiency in vitamin D is common in older adults and is associated with increased risk of osteoporosis and fractures. It is particularly concerning in ASD patients, where poor bone quality can exacerbate spinal deformity and complicate treatment [1-3].

Description

Physical activity is a cornerstone of bone health, particularly weight-bearing exercises that stimulate bone remodeling and strengthen the musculoskeletal system. In ASD patients, physical activity can improve not only bone health but also spinal stability, posture, and mobility. Weight-bearing exercises, such as walking, jogging, and stair climbing, place stress on bones and stimulate bone formation. Resistance exercises, such as weight lifting or resistance band training, strengthen muscles, which in turn support and protect the spine. Engaging in regular physical activity can help slow the

progression of bone loss and reduce the risk of falls and fractures in ASD patients. ASD patients should aim for at least 150 minutes of moderate-intensity aerobic exercise per week, combined with two to three sessions of resistance training targeting major muscle groups. Exercises that improve posture and balance, such as yoga or Pilates, can help reduce the risk of falls and improve spinal alignment in ASD patients. While physical activity is beneficial for bone health, ASD patients may have limitations due to pain, reduced mobility, or spinal instability.

In such cases, low-impact activities such as swimming, cycling, or water aerobics may be recommended to minimize stress on the spine while maintaining bone health. Pharmacological interventions play a vital role in managing osteoporosis and improving bone health in ASD patients. Several classes of medications are available to enhance bone density and reduce fracture risk. Bisphosphonates are the most commonly prescribed medications for osteoporosis. They work by inhibiting bone resorption, thereby preventing further bone loss and stabilizing bone density. In ASD patients with osteopenia or osteoporosis, bisphosphonates can be effective in reducing the risk of vertebral fractures and improving surgical outcomes by providing stronger bone for instrumentation [4,5].

Conclusion

Denosumab is a monoclonal antibody that inhibits osteoclasts, the cells responsible for bone resorption. It is particularly useful in patients who cannot tolerate bisphosphonates or have severe osteoporosis. Denosumab has been shown to significantly reduce the risk of vertebral fractures and is often used in conjunction with calcium and vitamin D supplementation. Parathyroid hormone analogues, such as teriparatide, are anabolic agents that stimulate new bone formation. They are particularly beneficial in patients with severe osteoporosis or those at high risk of fractures. In ASD patients, parathyroid hormone analogues can improve bone density and enhance the strength of spinal fusion constructs. In patients with severe ASD and poor bone health, surgical intervention may be necessary to correct spinal deformity, stabilize the spine, and prevent further progression. Several surgical techniques can be used to enhance bone health and improve surgical outcomes. Vertebral augmentation techniques, such as kyphoplasty or vertebroplasty, involve the injection of bone cement into fractured or weakened vertebrae to stabilize the spine and reduce pain. These procedures are often used in ASD patients with osteoporotic vertebral compression fractures.

Acknowledgement

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Conflict of Interest

None.

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