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ORTHOPEDIC REHABILITATION FOR OSTEOPOROSIS

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Abstract: Osteoporosis is a bone disorder in which bones become weak and prone to fracture. Osteoporotic bone has less density or mass, and the structure of bone tissue is far from normal. As bones become less dense, they become weaker and more likely to fracture. Women are four times more likely to have osteoporosis than men. Numerous studies show that weakness and atrophy can also affect the bone protrusions that hold dentures, resulting in improper fit. Regular dental visits, a healthy lifestyle, and a balanced diet high in vitamin D and calcium with regular physical activity are essential to strengthen and maintain good bone health.
Key words: osteoporosis, prosthodontic treatment, assessment of bone loss, bone mineral density.

Osteoporosis is an aggressive and progressive systemic bone disease characterized by low bone mass and deterioration of bone microarchitecture, leading to back pain and stooped posture, which increases the risk of fractures. Due to its multifaceted nature, this pathology affects physicians of all specialties, and the diagnosis of local manifestations of systemic osteoporosis in the jaw bone tissue is also a pressing issue in dentistry. This is primarily due to the significant prevalence of systemic osteoporosis in both Europe and America (Rozhinskaya L.Ya., 2007; Mulligan R., Sobel S., 2005). This disease has a definite adverse effect on both dental stability and the preservation of the residual alveolar ridge. [1]

Most literary sources indicate that osteoporosis is more common in women due to changes in hormonal status [Benevolenskaya L.I., 2005; Brown J.P., 2002; Khan, A.A., 2007]. In men, osteoporosis develops due to hypogonadism after 55 years of age. According to L.I. Benevolenskaya, O.M. Lesnyak (2005), I.I. Dedov (2006), A.G. Burduli, V.P. Smetnik (2011), A.A. Sveshnikov (2013), J.A. Kanis, A. Oden, H. Johansson et al. (2009), M.T. Drake, M.H. Murad, K.F. Mauck et al. (2012), with sex steroid deficiency, bone resorption prevails over its synthesis. Since depleted bone is more susceptible to the damaging effects of mechanical forces, resorption of the residual ridge occurs more often in these patients. Thus, orthopedic treatment of patients with osteoporosis should be aimed at improving the prognosis by modifying the conventional treatment plan to reduce the forces that cause progressive bone resorption. [2,3]

Osteoporosis was defined by the WHO in 1994 as "a disease characterized by low bone mass and deterioration of bone microarchitecture leading to increased bone fragility and a subsequent increase in fracture risk." It is defined as a disease in which bone mineral density is 2.5 standard deviations below the mean peak value in young adults [4-6].

Osteoporosis is divided into primary osteoporosis (cause unknown) and secondary osteoporosis (with a traceable etiology). [7]

This disease occurs in approximately one-third of the Western female population over 65 years of age [8]. The disease is estimated to affect over 200 million people worldwide [9] The main clinical manifestations include vertebral and hip fractures, but can occur anywhere in the skeleton. Clinical manifestations of vertebral fractures include loss of height, worsening

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scoliosis or kyphosis, significant back pain, and limited range of motion. Dental manifestations include: the cortex in the mandibular angle is noticeably thinned and poorly visible at the anterior margin of the ramus, and in the maxilla, it is minimal along the alveolar ridge [10] .
Risk factors for osteoporosis are roughly divided into modifiable and non-modifiable factors. Habits such as smoking, sedentary lifestyle, intestinal disorders that lead to insufficient absorption of Ca and P, vitamin D deficiency, and renal impairment can be modified to reduce the risk of osteoporosis. Non-modifiable risk factors include age, gender, family history, menopausal status, and ethnicity [11].
In the literature, two types of osteoporosis are defined as primary and secondary. Primary osteoporosis is considered a disease of unknown origin. It can occur with age and accelerates during menopause, also known as senile osteoporosis. Secondary osteoporosis, on the other hand, is secondary to known causes, which may include dietary factors, lifestyle, or the patient's medical condition. Medical conditions that may be associated with osteoporosis include genetic mutations leading to hypogonadism, endocrine disorders, hematological disorders such as multiple myeloma, leukemia, autoimmune disorders, and Parkinsonism. [12]
In both primary and secondary types, the underlying mechanism is an imbalance in bone formation and resorption, leading to inadequate peak bone mass, where the skeleton acquires insufficient mass and strength during growth. Inadequate new bone formation and excessive bone resorption lead to the development of brittle bone tissue.[13]
Hormonal factors largely determine the rate of bone resorption. Estrogen deficiency leads to osteoporosis by: 1) increasing the formation and decreasing the apoptosis of osteoclasts; 2) suppressing the synthesis of proinflammatory cytokines, which leads to increased formation of preosteoclasts in the bone marrow [14].
Bone density can be assessed by an orthopedic dentist using linear measurements (morphometric analysis) or by measuring the optical density of bone tissue (densitometry) [15]. Computer-aided image densitometric analysis (CADIA) is a practical method for measuring bone density changes in the alveolar ridge. It compares two serial images obtained with standard projection geometry and balances them for differences in image density, yielding a buccolingual depth of lesion. Thus, it represents a volumetric description of density changes [16].
The cortical portion of the mandible is more dependent on overall bone loss than the trabecular portion or the remaining alveolar ridge height. It has been reported that the buccal cortex in the area distal to the mental foramen correlates better with skeletal mineral density values than the lingual cortex. Oral signs of osteoporosis may manifest as excessive alveolar ridge resorption, tooth loss, chronic destructive periodontal disease, referred pain in the maxillary sinus, or a fracture. Alveolar bone resorption is influenced by the severity of the underlying periodontal disease and the quality of the prosthesis, if the patient wears a denture. Panoramic dental radiographs are commonly used in dental disease screening [17].
Residual ridge resorption in patients with complete dentures is a biological phenomenon that results in reduced biomechanical loading on the bone, thereby reducing intra- and periosteal stresses that lead to resorption. Hirai et al. indicated that osteoporosis significantly influences residual ridge reduction in edentulous patients. Several other studies have also concluded that significant mandibular ridge height and local or systemic bone loss are associated with this [18].
Implant-supported removable dentures improve chewing force and, consequently, mandibular bone loading compared to conventional complete dentures. Hutton et al. conducted a multinational and multicenter study in which patients were treated with implant-supported

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removable dentures in the mandible and/or maxilla [19]. The results show that individuals with poor bone quality (very thin cortical bone with low-density and poor-strength cancellous bone) and severe alveolar ridge resorption at the implant site exhibit the highest risk of implant failure. Mandibular osteoporosis before implant treatment may pose a risk of slightly increased marginal bone loss around the implant, but not implant failure within 5 years. Thus, considering the aforementioned studies, implant-supported removable dentures are the method of choice after complete tooth loss due to their bone-preserving effect and can also be recommended for individuals with osteoporosis [20].

Humphreys et al. conducted a study of mandibular alveolar bone resorption in edentulous elderly individuals and concluded that women over 50 years of age with osteoporosis require new dentures three times more often than women of the same age. In such patients, reducing the bone load by modifying the treatment plan with special precautions is considered [21]. Curtis et al. reported that the greatest resorption is observed in the mediolateral parts of the mandible, while less resorption occurs in the anterior part. It was also reported that the clinical height of the region distal to the mental foramen correlated more closely with the overall bone loss status than the anterior region [22].

When fabricating removable dentures, primary attention should be paid to reducing the forces on the residual ridge. To reduce mechanical forces, mucostatic or open-mouth impression methods, or selective pressure impression methods, should be used. Semi-anatomical or non-anatomical teeth with a narrow buccolingual width should be selected. Optimal use of soft liners, increased inter-tissue spacing, and not allowing dentures to be in the mouth for 10 hours a day are recommended. When fabricating fixed partial dentures on abutments with compromised periodontitis, this can accelerate bone loss in patients with osteoporosis. Therefore, the fabrication of fixed dentures should follow osteoporosis treatment rather than precede it [23].

Osteoporosis is a health condition that significantly affects bones, weakening them and making them easily fractured. In addition to deteriorating overall health and well-being, osteoporosis also has a direct impact on oral and dental health. It is important to understand that the disease can cause jaw stiffness. It also causes dental and oral health problems, including gum or periodontal disease and tooth loss. The dental effects of osteoporosis tend to affect women more than men. It's also worth noting that even if someone has no teeth and doesn't wear dentures, the effects of osteoporosis can affect dental and oral health. Weakness and bone loss can also affect the ridges on the body that hold dentures in place, causing dentures to fit poorly. Research also shows that people with this condition are more likely to need new dentures than those with strong, healthy bones [24].

Osteoporosis severely impacts the jawbone, which supports teeth, likely leading to tooth loss or mobility. Low jaw bone density caused by osteoporosis can also lead to other dental problems. For example, women with osteoporosis are more likely to experience difficulties with ill-fitting or loose dentures. The results of various oral and maxillofacial surgeries are also undesirable for these women [25].

Osteoporosis has been suggested as a risk factor for dental implant failure, but data supporting this association are limited [26].

Randomized clinical trials report implant failure in patients with osteoporosis after menopause. Studies that contraindicate the use of implants in patients with osteoporosis conclude that impaired bone metabolism leads to decreased bone healing around the implants. Other authors believe that the presence of osteoporosis is not a definitive contraindication to dental implant therapy. In patients with osteoporosis, the dentist must properly plan treatment, modify the

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implant geometry, use a larger diameter implant, and treat the surface. Therefore, osteoporosis is not a contraindication for implantation, as an accurate bone quality analysis is performed using tomography [26].

The best way to manage this problem is to not delay dental treatment. Regular dental visits are essential to address oral and dental health issues caused by weak bones. A healthy lifestyle is essential to strengthen and maintain good bone health.

Osteoporosis is a debilitating disease with significant physical and psychological consequences. Quality of life can be significantly improved: a healthy diet, weight-bearing exercise, and medications can help prevent bone loss or strengthen already weakened bones. Osteoporosis has potential prosthetic consequences associated with bone loss, tooth loss, and TMJ pathology. Studies have shown a correlation, visible on panoramic radiographs, between osteoporosis and residual ridge resorption. Mandibular indices can be used as an early detection tool. An orthopedic surgeon, having identified these characteristics, will have the advantage of referring the patient for bone density screening for early diagnosis and subsequent treatment.

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