

Effects of removable dental prostheses on mandibular bone density in postmenopausal osteoporotic patients

Sinan Ateş¹, Belgin Gülsün²

¹ Bingöl University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Bingöl, Turkey

² Dicle University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Diyarbakır, Turkey

Correspondence:

Dr. Sinan ATEŞ

Bingöl University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Bingöl, Turkey.

E-mail: sinanates1987@gmail.com

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Abstract

Aim: The aim of this study is to investigate the effects of removable dental prostheses on mandibular bone density in postmenopausal osteoporotic patients.

Methodology: The prospective study included 30 female patients aged 45-70 years who had been previously diagnosed with postmenopausal osteoporosis. The patients had no diseases affecting bone metabolism. The patients were divided into two groups: (i) patients who were using removable dental prostheses (n=15) and (ii) patients who were not using removable dental prostheses (n=15) (the control group). A whole-body dual energy x-ray absorptiometry (DXA) scan was performed to calculate the mandibular bone densities of the patients.

Results: The use of removable mandibular prostheses did not cause a significant change in mandibular bone density.

Conclusion: The fact that removable mandibular prostheses did not cause a significant change in mandibular bone density could be because the patients started using the removable prostheses long after they lost their teeth.

Keywords: postmenopausal osteoporosis, removable dental prosthesis, bone mineral density, DXA

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Introduction

Osteoporosis is a disease that can lead to the weakening of the skeleton and partial or complete breaking of the bones during a mild strain or normal movement. Osteoporosis has recently become a subject of interest to physicians, patients, and communities at large due to improved life expectancies worldwide. The disease is highly insidious and causes no symptoms until a fracture occurs. It also has high morbidity and even

mortality and has many negative effects on quality of life, and its treatment is highly costly (1).

Bone density decreases in osteoporotic bones. As the bone density decreases, the bone becomes weaker and thus more prone to fracture. The weakening or loss of bone can affect the alveolar crests and compromise the retention of removable prostheses. Therefore, osteoporotic patients change their prostheses more frequently than patients with healthy bones (2).

Almost 20% of the world's population uses removable dental prostheses (3). The number of partially edentulous patients is increasing day by day, and many patients will seek treatment for the restoration of their lost teeth. Although implant treatment has been established as a viable treatment for removable prostheses, partial prostheses continue to be preferred in clinical practice due to their numerous advantages (4).

Bone density is a key factor affecting bone quality. Therefore, even small changes in bone density may result in changes in bone strength (5). Bone density is affected by numerous factors, including bone metabolism, the mineral status of the skeleton, surgical procedures, occlusal forces transferred to the bone through dental implants, muscle activity, the presence of teeth, mandibular bone thickness, body mass index, and the use of certain medications (6).

Dual energy x-ray absorptiometry (DXA) is commonly used to directly measure bone mineral density and is considered the gold standard. In this method, the T score is used, which is calculated by comparing the bone mineral density of the individual with the bone mineral density values of healthy young adults of the same gender (7). A T score of less than -2.5 indicates osteoporosis, a score between -1 and -2.5 indicates osteopenia, and a score greater than -1 indicates normal bone density (8).

Determining the quality and density of bones with non-invasive methods is an important clinical practice. The mass, structural properties, and density of bones are considered mechanical components of the bones, and they play a critical role in maintaining osteointegration (9).

Both the amount and quality of the bone in the implant insertion site are crucial to the success of dental implants. Of note, the quality of the bone determines the treatment plan and the primary stability, size, design, and surface properties of the implants selected (10).

The aim of this study was to investigate the effects of removable dental prostheses on mandibular bone density in postmenopausal osteoporotic patients.

Materials and Methods

Patients

The prospective study included 20 postmenopausal women aged 45-75 years. The patients were divided into two groups: (i) patients who were using removable dental prostheses (n=15) and (ii) patients who were not

using removable dental prostheses (n=15) (the control group).

Patients aged 45-75 years who had entered menopause naturally, had not menstruated for at least one year, and had received a diagnosis of postmenopausal osteoporosis were included in the study. Patients with a history of trauma and maxillofacial reconstruction, cystic or tumoral lesions in the mandible, a history of mandibular surgery, systemic diseases affecting skeletal metabolism, and patients using drugs affecting the skeletal metabolism were excluded from the study.

The study was approved by the Dicle University Faculty of Dentistry's Ethics Committee (Date: March 15, 2017, No: 2017/3).

Assessment of bone mineral density

Mandibular bone density was assessed using DXA (Hologic, Discovery QDR 4500 A model DXA). A whole-body DXA scan was conducted with the patient in the supine position. Following the scan, the target site was determined as the region extending from the left mandibular symphysis to the angulus, and the values to be analyzed were obtained for each patient.

Statistical analysis

Data were analyzed using R version 3.2.3 (2015-12-10, Copyright [C] 2015, The R Foundation for Statistical Computing, a free software computer package program). Descriptives were expressed in terms of mean, standard deviation (SD), standard error (SE), and minimum-maximum values. Independent groups were compared using the independent samples t-test, and continuous variables (frequencies and percentages) were compared using a chi-square test. Correlations were assessed using the correlation coefficient. A p value of <0.05 was considered significant.

Results

The 30 patients had a mean age of 61.90±6.266 (range: 50-70) years. The mean age at the onset of menopause was 46.23 (range: 30-54) years, the mean time from the onset of menopause was 15.67 (range: 4-25) years, and the mean duration of removable prosthesis use was 7.4 (range: 5-10) years.

Table 1. Demographic and clinical characteristics

| | n | Minimum | Maximum | Mean | SD |
|---------------------------------------|----|---------|---------|-------|-------|
| Age (years) | 30 | 50 | 70 | 61.90 | 6.266 |
| Age at the onset of menopause (years) | 30 | 30 | 54 | 46.23 | 4.725 |

| | | | | | |
|--|----|---|----|-------|-------|
| Time from the onset of menopause (years) | 30 | 4 | 25 | 15.67 | 6.172 |
| Duration of removable prosthesis use (years) | 15 | 5 | 10 | 7.40 | 1.81 |

SD: Standard deviation

The analysis indicated that the use of dental prostheses had no significant effect on mandibular bone density.

Table 2. Effect of using removable prostheses on mandibular bone density

| | Groups | n | Mean | SD | SE | p |
|--------------------|---------------|----|--------|---------|---------|-------|
| Mandibular T score | Prosthesis | 15 | 1.6047 | 0.48065 | 0.12410 | 0.424 |
| Mandibular T score | No prosthesis | 15 | 1.5140 | 0.32652 | 0.08431 | 0.695 |

SD: Standard deviation, SE: Standard error, $p < 0.05$

Discussion

Osteoporosis is the most common chronic disease of the bone, characterized by increased bone fragility, associated with various factors such as menopause and aging. Although osteoporosis is seen in all age groups and both genders, it is more common in the elderly and women. The aging of the population due to the increase in life expectancy has turned osteoporosis into a global problem. Today, it is estimated that more than 200 million people suffer from osteoporosis. According to the statistics of the International Osteoporosis Foundation (IOF), one out of every three women and one out of every five men over the age of 50 are expected to experience osteoporosis-related fractures throughout their lifetime (11).

In the postmenopausal period, the incidence of fractures associated with Type I osteoporosis (postmenopausal osteoporosis) is increased due to estrogen deficiency (12). In women, the increased bone loss due to menopause elevates the risk of developing osteoporosis. For this reason, it has been reported that osteoporosis is mostly known as a female disease in the community and white Asian women in the postmenopausal period are at greater risk of developing osteoporosis (13,14).

Osteoporosis has a significant impact on dental practice. Of note, it plays a key role in the factors affecting prognosis, such as prosthesis planning, periodontal health, and oral surgical procedures.

The increase in the elderly population both in our country and in the world has led to a rise in the number of elderly patients presenting to dental clinics for various reasons. These reasons mostly include loss of teeth and correction of tooth losses with dental

prostheses, which are associated with the advancing age.

Nowadays, with the widespread use of implant treatment, many patients who previously used removable prostheses have started to prefer implant-supported fixed or removable prostheses. For this reason, knowing the effect of a removable prosthesis on the density of the bone to be implanted is highly important.

Knezović-Zlatarić et al. compared 20 removable partial denture wearers and 20 complete denture wearers and obtained two dental panoramic radiographs from each patient, of which the first was obtained prior to denture delivery and the second was obtained after 6 months of denture wearing. The authors measured bone mineral density on the panoramic radiographs and detected a significant increase in bone mineral density in the region 2 mm above the gonion in both groups (15).

Khojastehpour et al. evaluated 105 postmenopausal women divided into three groups as patients with normal bone density, osteopenia, and osteoporosis. The authors assessed bone mineral density on panoramic radiographs and found no significant difference between patients with normal bone density and patients with low bone density (osteopenia, osteoporosis) with regard to mandibular bone density (16).

Scheibel et al. examined the correlation between maxillomandibular alveolar bone density and systemic bone density in 23 middle-aged women and assessed bone mineral density with DXA of anterior and posterior maxillomandibular alveolar bone in the standard sites for the assessment of bone mineral density (lumbar spine, femur, third cervical vertebra). The authors found a significant correlation between the bone

density of the maxillary alveolar bone and the bone density of the femoral neck. However, among the densities of the alveolar bones, only the anterior maxilla and the posterior mandible were significantly correlated (17).

Pavičić et al. evaluated the effect of frequency of wearing removable partial dentures on the alveolar bone density changes around the abutment teeth using the intraoral microdensitometry method in 50 subjects of both genders. The subjects comprised 31 (62%) examinees who were wearing the dentures 24 hours a day and 19 (38%) examinees who were wearing them only during the day. Two retroalveolar radiographs were obtained, of which the first was taken before the removable partial denture delivery and the second was taken after three months of denture wearing. The authors found that the use of removable partial dentures for three months had no significant effect on the alveolar bone density changes around the abutment teeth (18).

Conclusions

The results indicated that the use of removable mandibular prostheses did not cause a significant change in mandibular bone density. This finding could be attributed to the fact that patients started using removable prostheses long after they lost their teeth.

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