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Comparative Evaluation of DMF Scores in Patients Using Bisphosphonates: A Retrospective Study

Bifosfonat Kullanan hastalarda DMF Skorlarının Karşılaştırmalı Değerlendirmesi: Bir Retrospektif Çalışma

ABSTRACT

Objectives

This study aimed to evaluate the association between bisphosphonate use and the prevalence of dental caries in comparison with systemically healthy controls.

Material and Methods

This retrospective study included 100 patients: 50 were on bisphosphonate medication and 50 were healthy controls who were matched for age and gender. Between 2013 and 2023, each participant was recorded in the database of Akdeniz University's Faculty of Dentistry. Dental health markers, such as the number of undamaged teeth, restorations, and the prevalence of caries, were evaluated using panoramic radiography. The analysis did not include third molars. Following established standards, two skilled dentists independently assessed the radiographs. Patients between the ages of 18 and 70 were included in the inclusion criteria, however those with major radiographic artifacts, crowns, implants, or tooth loss were excluded. The end measures included the DMF index, the number of caries-affected teeth, the number of teeth that were treated, and the number of teeth that were fully intact. To use the independent samples t-test for statistical analysis, these parameters were compared between the bisphosphonate and control groups ($P < 0.05$).

Results

There was no statistically significant difference between the groups (p = 0.26), with the mean DMF index for healthy people being 8.42 and for bisphosphonate users being 9.32. The number of restored teeth (3.0 vs. 2.4, respectively; p = 0.08), carious teeth (2.08 vs. 2.34, respectively; p = 0.52), and sound teeth (20.12 vs. 20.32, respectively; p = 0.59) did not differ significantly either.

Conclusion

The DMF index, the number of sound teeth, restored teeth, and carious teeth did not differ statistically significantly between bisphosphonate users and healthy people. The DMF index did not significantly rise among bisphosphonate users. It is advised that bigger sample sizes be used in future research to validate these results.

Key words

Bisphosphonates, Dental caries, DMF index, Panoramic x-ray

ÖZ

Amaç

Bu çalışmanın amacı, sistemik olarak sağlıklı bireylerle karşılaştırıldığında hastalarda çürük görülme sıklığı ile bifosfonat kullanımı arasındaki ilişkiyi araştırmaktır.

Gereç ve Yöntemler

Bu retrospektif çalışmada 100 hasta yer aldı: 50'si bisfosfonat tedavisi gören hastalar, 50'si ise yaş ve cinsiyet açısından eşleştirilmiş sağlıklı kontrol grubu hastalarıdır. 2013 ile 2023 yılları arasında, her katılımcı Akdeniz Üniversitesi Diş Hekimliği Fakültesi'ne bir giriş yapmıştır. Sağlam diş sayısı, restorasyonlar ve çürük prevalansı gibi diş sağlığı bulguları panoramik radyografiler kullanılarak değerlendirildi. Analiz üçüncü molarları kapsamadı. Yerleşik standartlara göre, iki uzman diş hekimi radyografileri bağımsız değerlendirdi. Çalışmaya 18-70 yaş aralığındaki hastalar dahil edildi, ancak radyografik artefaktları bulunanlar, kronu, implantı olanlar ya da diş kaybı bulunanlar ise dışlandı. Son ölçümler arasında DMF indeksi, çürükten etkilenen diş sayısı, tedavi edilen diş sayısı ve tamamen sağlam diş sayısı yer aldı. İstatistiksel analiz için bağımsız örnekler t-testi kullanmak üzere, bu parametreler bisfosfonat ve kontrol grupları arasında karşılaştırıldı ($P < 0.05$).

Bulgular

Gruplar arasında istatistiksel olarak anlamlı bir fark yoktu (p = 0.26), sağlıklı kişilerde ortalama DMF indeksi 8.42, bifosfonat kullanıcılarında ise 9.32 idi. Restore edilmiş diş sayısı (sırasıyla 3.0 ve 2.4; p = 0.08), çürük diş sayısı (sırasıyla 2.08 ve 2.34; p = 0.52) ve sağlam diş sayısı (sırasıyla 20.12 ve 20.32; p = 0.59) arasında da istatistiksel olarak anlamlı bir fark görülmedi.

Sonuç

DMF indeksi, sağlam diş sayısı, restore edilmiş diş sayısı ve çürük diş sayısı, bifosfonat kullanıcıları ile sağlıklı kişiler arasında istatistiksel olarak anlamlı bir fark göstermemiştir. DMF indeksi, bifosfonat kullanıcıları arasında anlamlı bir artış göstermemiştir. Bu sonuçları doğrulamak için gelecekteki araştırmalarda daha büyük örneklemlerin kullanılması tavsiye edilir.

Anahtar Sözcükler

Bisfosfonatlar, Diş çürükleri, DMF indeksi, Panoramik röntgen

INTRODUCTION

Bisphosphonates are potent inhibitors of osteoclastic bone resorption and are widely prescribed for the prevention and management of osteoporosis, Paget's disease, and malignancy-related bone disorders (1). Their clinical efficacy in reducing fracture risk and improving bone mineral density has been well established over the past several decades. However, since the first description of bisphosphonate-associated osteonecrosis of the jaws (ONJ) in 2003 (2,3), greater attention has been directed toward the potential oral and maxillofacial complications associated with long-term bisphosphonate therapy. Although the incidence of ONJ remains relatively low, the condition can lead to severe morbidity, including chronic pain, infection, and impaired oral function, thereby substantially affecting patients' quality of life.

Accumulating evidence indicates that dental extractions are the most common precipitating event in the development of ONJ, accounting for approximately three-quarters of all reported cases (4,5). The risk is markedly elevated among patients receiving intravenous bisphosphonates, particularly those undergoing treatment for malignancies, with an estimated incidence ranging between 1% and 10% following dental extraction (6). In contrast, patients on oral bisphosphonates for osteoporosis exhibit a significantly lower risk, estimated between 1 in 225 and 1 in 1100 cases (7). Nevertheless, given the widespread use of bisphosphonates-estimated to include thousands of patients in countries such as Australia-the absolute number of potential ONJ cases remains clinically relevant (8). Moreover, because dental disease is highly prevalent among older adults, even a low individual risk can translate into a considerable population-level burden.

Preventive oral health care thus plays a crucial role in mitigating this risk. If patients initiating bisphosphonate therapy are rendered dentally healthy prior to treatment-by addressing existing carious lesions, periodontal inflammation, and non-restorable teeth-future dental extractions may be avoided, thereby significantly reducing the likelihood of ONJ development (9). The oral health status of patients receiving bisphosphonates is therefore a critical determinant of both oral and systemic well-being. Maintaining optimal dental health throughout treatment is not only essential for maintaining quality of life but may also serve as a preventive strategy against medication-related complications (10).

Despite the clinical significance of this issue, there is limited research investigating the general oral health parameters of patients using oral bisphosphonates. It has often been assumed that these individuals maintain oral health similar to that of the general population matched for age, sex, systemic health, and socioeconomic status. Conversely, some have proposed that individuals who adhere to long-term bisphosphonate therapy may, in fact, exhibit better-than-average oral health behaviors, given their

proactive approach to managing general health conditions (11). However, there is still insufficient evidence to support either assumption (12).

The Decayed, Missing, and Filled Teeth (DMF) index is a widely accepted epidemiological indicator that reflects the cumulative experience of dental caries and overall oral health status. Evaluating DMF scores among bisphosphonate users may thus provide valuable insights into their dental condition and help identify possible risk factors associated with ONJ or other oral complications.

This study aimed to evaluate the association between bisphosphonate use and the prevalence of dental caries in comparison with systemically healthy controls. The null hypothesis of the present study is; H_{01}: There is no statistically significant difference in the DMF index between patients using bisphosphonates and systemically healthy individuals. H_{02}: There is no statistically significant difference in the number of sound teeth, restored and carious teeth between patients using bisphosphonates and systemically healthy individuals.

MATERIAL and METHODS

Study design and sample selection

The study protocol was approved by the Ethics Committee of Akdeniz University (Approval No: 2025/192). All patient data were anonymized prior to analysis to ensure confidentiality and compliance with institutional data protection guidelines.

This retrospective comparative study included 100 patients, including 50 individuals who were using bisphosphonate medication and 50 systemically healthy controls. The control group was matched to the bisphosphonate group based on age and gender to minimize confounding effects. All patient data were obtained from the archives of the Faculty of Dentistry, Akdeniz University, spanning the years 2013 to 2023.

Patients aged 18 to 70 years were eligible for inclusion. Exclusion criteria included individuals younger than 18 years, those who had missing more than half of their teeth, or those with crowns, fixed partial dentures, or other extensive prosthetic restorations. Patients with a history of dental trauma or surgical procedures leading to tooth loss, as visible on panoramic radiographs, were also excluded. Radiographs exhibiting significant artifacts that interfered with diagnostic accuracy were excluded from the analysis.
Radiographic evaluation

Panoramic radiographs were used to assess dental health parameters, including the number of sound, restored, and caries-affected teeth. These data were subsequently used to calculate the Decayed, Missing, and Filled Teeth (DMF) index for each participant. Third molars were excluded from all evaluations for standardization purposes.
To ensure methodological consistency, caries detection and scoring were performed by two experienced restorative dentistry specialists. Prior to the assessment, both examiners were calibrated according to established diagnostic criteria. Radiographs were examined on a high-resolution computer monitor under dim lighting, using ×3.5 magnification to improve visualization. Each examiner independently reviewed the images, and any discrepancies in tooth-level diagnoses were resolved by discussion until consensus was reached.

Statistical analysis

Comparative analyses between bisphosphonate users and controls were performed using the independent samples t-test. Parameters analyzed included the DMF index, number of caries-affected teeth, restored teeth, and sound teeth. Statistical significance was set at a p-value < 0.05.

RESULTS

A bar graph was generated to compare the mean number of restored teeth between bisphosphonate users and healthy controls. The results indicate that healthy individuals had a slightly higher mean number of restored teeth (mean ± SD: 3.00 ± 1.0) compared to bisphosphonate users (mean ± SD: 2.40 ± 1.2). Error bars representing standard deviations are shown for each group. These measurements were included in the analysis of dental restoration status and were used to evaluate differences between the two groups using an independent samples t-test (Fig. 1).

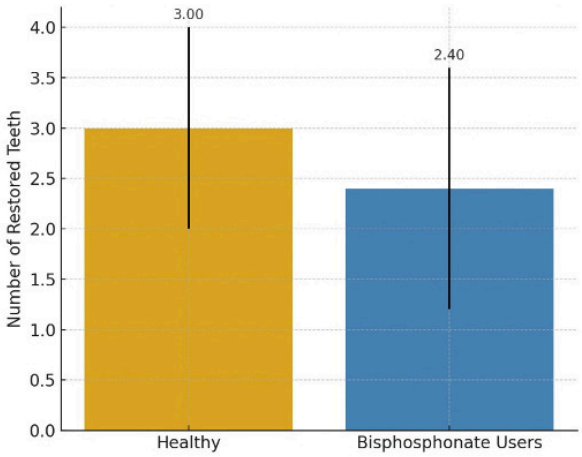


Figure 1. Comparison of restored teeth between healthy individuals and bisphosphonate users.

As shown in Figure 2, the mean number of sound teeth was comparable between the healthy control group (20.12 ± SD) and bisphosphonate users (20.32 ± SD). Statistical analysis using the independent t-test revealed no significant difference between the groups ($P > 0.05$).

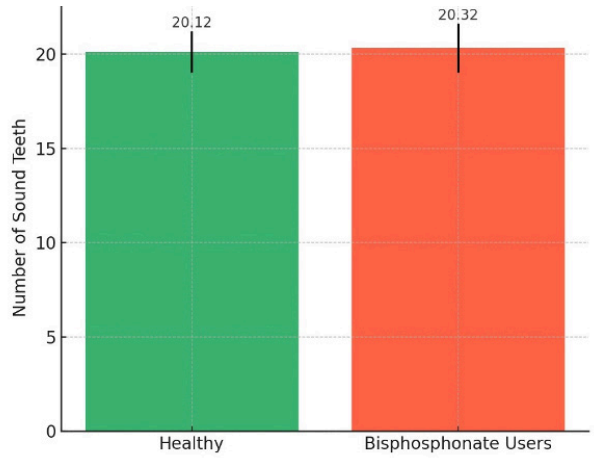


Figure 2. The mean number of sound teeth in healthy individuals and bisphosphonate users.

The mean number of carious teeth was slightly higher among bisphosphonate users (2.34 ± SD) compared with healthy individuals (2.08 ± SD); however, this difference was not statistically significant ($P > 0.05$, independent t-test) (Fig. 3).

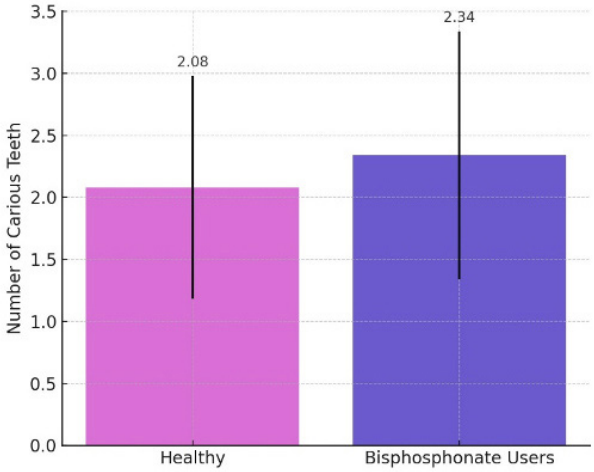


Figure 3. The mean number of carious teeth between healthy individuals and bisphosphonate users.

The mean DMF index was slightly higher in bisphosphonate users (9.32 ± SD) compared with healthy individuals (8.42 ± SD) in Figure 4. However, the difference between the groups was not statistically significant ($P > 0.05$, independent t-test).

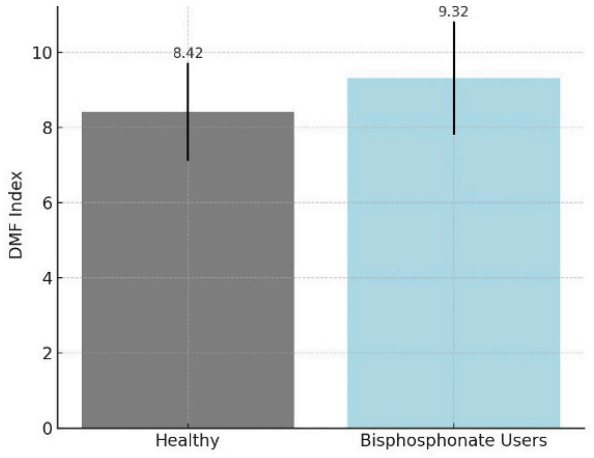


Figure 4. Comparison of the mean DMF index between healthy individuals and bisphosphonate users.

DISCUSSION

The present study compared the general oral health status of patients taking bisphosphonate medications with that of systemically healthy individuals by evaluating parameters such as the DMF index, number of sound teeth, restored teeth, and carious teeth. Although no statistically significant differences were detected between the groups, bisphosphonate users showed slightly higher DMF scores and a greater mean number of carious teeth, indicating a trend toward a marginally poorer dental condition.

Therefore, the first and second null hypotheses were accepted. These findings align with previous investigations repor- ting that long-term bisphosphonate therapy may indirectly affect oral health outcomes through changes in salivary function, mucosal tissue quality, or bone metabolism (1,13). While bisphosphonates are not inherently cariogenic, their systemic effects - particularly reduced bone remodeling and potential alterations in the oral microenvironment - may impact dental maintenance and healing capacity following oral procedures (14,15).

In the present study, the mean DMF index among bisphosphonate users (9.32 ± SD) was marginally higher than that of the control group (8.42 ± SD), although this difference was not statistically significant ($P > 0.05$). Similar findings were reported by Oubbaih *et al*. (16) who found that bisphosphonate users exhibited comparable caries experience to healthy controls, emphasizing that medication use alone does not necessarily deteriorate oral health as long as adequate hygiene and regular dental care are maintained. Conversely, Kalra *et al.* (17) noted that many bisphosphonate users - particularly elderly or polymedicated patients - may experience diminished oral health behaviors, which could increase the risk of caries and tooth loss if not adequately monitored.

The lack of statistically significant differences in restored and sound teeth between the two groups in this study suggests that bisphosphonate users likely maintain similar access to restorative dental care as systemically healthy individuals. This observation supports the hypothesis proposed by Shani *et al.* suggesting that patients who adhere to long-term medical therapy may also demonstrate greater compliance with preventive and therapeutic dental measures (18).

Nevertheless, the slightly higher DMF index observed among bisphosphonate users could reflect the influence of age, systemic comorbidities, and reduced salivary flow - factors known to contribute to increased caries susceptibility in elderly populations (19,20).

From a preventive perspective, maintaining optimal oral health before and during bisphosphonate therapy remains essential. The literature strongly supports the role of dental extractions and active periodontal disease as major predisposing factors for ONJ development (21,22). Therefore, early detection and treatment of carious lesions and regular professional dental follow-up are crucial components of patient management.

The present findings highlight the importance of multidisciplinary collaboration between dentists and physicians in the management of patients undergoing bisphosphonate therapy. While bisphosphonates effectively prevent osteoporotic fractures and skeletal events in malignancies, comprehensive oral care can minimize the risk of medication-related complications.

This study has several limitations. First, its retrospective design limits the ability to control for confounding factors such as oral hygiene practices, diet, and medication duration. Second, the use of panoramic radiographs, while practical for large-scale evaluation, may underestimate incipient proximal caries compared with bitewing radiographs. Finally, the sample size was modest and limited to a single center, which may restrict the generalizability of the findings.

CONCLUSION

Within the limitations of the present study, the DMF index and the number of sound, restored, and carious teeth did not differ significantly between bisphosphonate users and healthy individuals. Although a slight increase in the DMF index was noted among bisphosphonate users, the difference was not statistically significant, indicating that bisphosphonate use may not have a major impact on overall dental status. However, due to the modest sample size and cross-sectional design, these results should be interpreted with caution.

Future studies with larger populations, longitudinal designs, and more comprehensive clinical and radiographic parameters are recommended to further clarify the potential effects of bisphosphonate therapy on oral and dental health.

Ethics Committee Approval

The study was approved by the Akdeniz University Ethics Committee (2025/192).

Author contribution statement

Concept: N.B., M.E., O.T.H.; Design: N.B., M.E.,O.T.H.; Supervision: N.B., M.E., O.T.H.; Resources:N.B., M.E., O.T.H.; Materials: N.B., M.E., A.Z.Y., E.M.E., A.T. ; Data Collection and/or Processing: M.E., A.Z.Y., E.M.E., A.T. ; Analysis and/ or Interpretation: O.T.H.; Literature Search: N.B., O.T.H.; Writing Manuscript :N.B., O.T.H.; Critical Review: N.B., O.T.H.

Informed Consent

Written informed consent was obtained from participants who participated in this study.

Conflict of Interest

The author declare that they have no conflict of interest.

Financial Disclosure

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