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Radiographic Evaluation of Bruxism-Related Mandibular Bone Adaptation in Periodontitis and Non-Periodontitis

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Abstract

Background: Bruxism (BR) defined as repetitive jaw muscle activity, is a parafunctional condition linked to occlusal trauma and bone remodeling. Although the effects on the periodontium are debated, the connection between mechanical stress from BR and mandibular bone adaptation, especially in those with periodontitis, has not been thoroughly examined. This study aimed to evaluate the grade and symmetry of mandibular bone apposition in individuals with probable BR comparing those with periodontitis and non-periodontitis.

Methods: A total of 110 adults diagnosed with BR were recruited for the study. Participants were divided into 2 groups based on their periodontal status: those with periodontitis and non-periodontitis. Panoramic radiographs assessed bone apposition in the gonial region, graded on a scale from 0 to 3. Clinical periodontal parameters, including probing depth, clinical attachment loss, and bleeding on probing, were recorded alongside demographic data. Group comparisons were conducted using ANOVA and chi-square tests, with additional regression and symmetry analyses (Bowker's test and Cohen's Kappa) applied to evaluate side-specific apposition patterns.

Results: Participants diagnosed with periodontitis tended to be older and exhibited more severe clinical parameters and tooth loss compared to those without periodontitis (P < .0001). The periodontitis group had a higher occurrence of advanced bone apposition grades (G2 and G3), especially on the left side of the mandible. A significant asymmetry was observed between bone apposition grades G0 and G1 in side-to-side comparisons (P = .0078), suggesting unilateral early-stage bone remodeling in certain individuals. Conversely, advanced apposition grades were generally bilateral and linked to periodontitis.

Conclusion: The results suggest that periodontitis may impact both the extent and distribution pattern of mandibular bone apposition in individuals with BR. Radiographic identification of bone apposition, especially regarding periodontal degradation, could provide further diagnostic benefits for evaluating occlusal overload and mandibular bone adaptation.

Keywords: Bruxism, mandibular bone apposition, periodontitis

INTRODUCTION

Bruxism (BR), characterized by repetitive masticatory muscle activity, manifests as either awake or sleep BR, with estimated prevalence rates of approximately 30% and 15%, respectively.[1] This parafunctional activity is clinically relevant due to its potential

What is already known on this topic?

- *Bruxism (BR) can lead to adaptive bone changes in the mandible, especially in the gonial region, which can be detected using panoramic radiography.*
- *Periodontitis is a chronic inflammatory disease that can affect the dynamics of bone remodeling in the mandible.*
- *The relationship between BR and periodontal disease, and its potential impact on mandibular bone adaptation, has not been completely clarified in radiographic studies.*

What does this study add on this topic?

- *This study demonstrates that individuals with both probable BR and periodontitis exhibit higher degrees and more symmetrical mandibular bone apposition compared to individuals without periodontitis.*
- *Bilateral asymmetry in bone apposition appears more frequently in individuals without periodontitis, suggesting a potential role of periodontal inflammation in modulating bone adaptation patterns.*
- *These findings provide new radiographic evidence supporting the hypothesis that chronic periodontal inflammation may influence the skeletal response to parafunctional mechanical forces.*

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to cause muscle fatigue, discomfort in the masticatory system, temporomandibular joint pain, and hypertrophy of the jaw muscles.[2,3]

During mastication, vertical forces applied to individual teeth typically range from 20 to 150 N depending on food consistency, with peak values reaching 250 N in isolated cases. In contrast, maximal voluntary bite forces may exceed 500-700 N, while forces generated during sleep BR may surpass even these values.[4,5] Such intense and repetitive forces can affect not only the teeth but also the surrounding periodontal structures, especially the alveolar bone.[6]

The potential of occlusal forces to induce changes in mandibular bone architecture was first proposed by Wolff[7] in 1892. According to Wolff's law, bone adapts its internal structure and external form in response to mechanical stress.[7] Bone remodeling is influenced both by intrinsic factors, such as genetic predisposition, and extrinsic behavioral factors, including BR.[2] Even though BR can be evaluated using a combination of self-reports, clinical assessments, and instrumental methods such as electromyographic recordings and polysomnography, often supported by audio or video documentation.[8] Clinical radiography can serve as a diagnostic tool to evaluate the changes in terms of cortical thickness or bone apposition as an adaptive bone remodeling response, particularly in areas subjected to repeated functional or parafunctional loading.[9] Recent studies have demonstrated that mandibular bone apposition may be more prominent in individuals with BR, particularly in the angle or gonial region, as visualized on panoramic radiographs.[10,11] Periodontal diseases rank among the most prevalent diseases globally and pose a significant public health challenge, leading to adverse social and economic impacts.[12] Although periodontal disease is primarily associated with microbial and inflammatory processes, the potential contribution of excessive occlusal forces, particularly those arising from BR, remains a subject of ongoing debate.[13,14] When the intensity of occlusal loading exceeds the adaptive capacity of the periodontal tissues, tissue damage may ensue. In this context, primary occlusal trauma refers to periodontal damage resulting from pathologic occlusal forces in the absence of inflammation.[15] Given the multitude of factors that may contribute to occlusal overload, it is crucial to evaluate the specific effects of each, among which BR is one of the most prevalent and clinically significant.[13] However, the relationship between BR, periodontal disease, and radiographically detectable bone changes remains insufficiently explored.[4,10] Furthermore, it remains unclear whether the presence of periodontitis alters the bone's adaptive capacity in response to mechanical stress.

In light of this, the present cross-sectional study aimed to investigate how the mandibular bone adapts to parafunctional occlusal forces in individuals with probable BR, stratified by the presence or absence of periodontitis. The evaluation focused on the degree and bilateral symmetry of bone apposition in the mandible. The null hypothesis of this study was that periodontal disease status has no significant effect on the degree or bilateral symmetry of mandibular bone apposition in individuals with probable BR.

MATERIALS AND METHODS

This study was conducted in full accordance with the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Ankara Medipol University (Approval No.: E-85859696-604.01.01-3467, Date: April 30, 2025). All participants were informed about the aims and procedures of the study, and written informed consent was acquired prior to participation. Personal identifiers were anonymized to maintain confidentiality. Participation was entirely voluntary, and no financial incentives were provided. The research was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology Statement (STROBE) guidelines.[16]

This study used a non-instrumental BR assessment based on international diagnostic criteria.[8] Polysomnography and electromyography were not employed; rather, BR was diagnosed through a mix of self-reported behaviors and clinical evaluation.[8] Participants were asked to follow up for 1-2 weeks, noting any instances of clenching, grinding, or mandibular bracing/thrusting while awake or asleep. The clinical assessment focused on the typical signs of BR, which include abnormal tooth wear, masticatory muscle hypertrophy, and soft tissue indicators like a scalloped tongue or linea alba. Those who reported BR-related activities and showed at least one clinical sign were categorized as having "probable bruxism" based on the revised grading system by Lobbezoo et al[8] Only participants who fulfilled the criteria for BR were involved in the final analysis to maintain diagnostic consistency and methodological integrity.

The study included individuals who applied to Ankara Medipol University, Faculty of Dentistry with complaints of BR. All BR participants were over 18 years old, had no history of physical trauma to the head or neck, had not previously undergone orthodontic treatment, were not receiving chemotherapy or radiotherapy, were not taking medications influencing skeletal and muscle metabolism, and had not received any periodontal treatment within the past year.

Radiographic Evaluation

Digital panoramic radiographs were obtained for all participants using a standardized protocol. The radiographic evaluation focused on identifying mandibular bone apposition in the gonial. Bone apposition was graded using a 4-point ordinal scale (Grade 0 to Grade 3), based on morphological criteria adapted from previously published studies.[4,17] The criteria were as follows:

Grade 0 (G0): No directional change, no visible bone apposition.

Grade 1 (G1): Directional change from the convex contour of the basal cortex. No bone apposition.

Grade 2 (G2): Directional change with generalized bone apposition and an inhomogeneous surface.

Grade 3 (G3): Directional change plus localized bone apposition at 1 or more locations.

Two calibrated examiners (H.E. and F.S.) assessed each radiograph independently, without knowing the participants' periodontal status. To measure examiner reliability, the agreement between examiners was evaluated for grading bone apposition using Cohen's Kappa statistics on a subset of 20 randomly selected radiographs. The results showed substantial agreement for both intra-examiner (κ=0.82) and inter-examiner reliability (κ=0.76). Both the right and left mandibular angles were evaluated separately, and asymmetries in bone apposition were noted.

Periodontal Assessments

Participants' periodontal health was determined based on clinical and radiographic findings. Periodontal status was categorized as either "periodontitis" or "non-periodontitis" following the case definitions outlined by the 2017 Classification of Periodontal and Peri-Implant Diseases and Conditions.[18] Clinical parameters, including probing depth (PD), clinical attachment level (CAL), and bleeding on probing (BOP), were recorded.

Participants were diagnosed with periodontitis if they met the following case definition:

- Interdental CAL present at ≥2 non-adjacent teeth, or
- Buccal/oral CAL ≥3 mm with pocketing >3 mm at ≥2 teeth, and
- Radiographic evidence of alveolar bone loss.

Periodontitis staging (I-IV) was based on the severity and complexity of clinical findings, including the extent of CAL and bone loss, PD, tooth loss due to periodontitis, and site-specific factors such as vertical defects or furcation involvement.

Participants not meeting the criteria for periodontitis were categorized as non-periodontitis, which included:

- Periodontally healthy individuals, defined as having BOP < 10%, no CAL, and no radiographic bone loss (i.e., a clinically and radiographically intact periodontium);
- Gingivitis on an intact periodontium is defined as BOP ≥ 10% in the absence of CAL and radiographic bone loss. Only those with gingivitis on an intact periodontium were included in the study.

The final group assignment was confirmed by 2 periodontists (F.S., Z.G.), who independently reviewed the clinical data and radiographs.

Statistical Analysis

Power analysis was performed using GraphPad Prism version 10 (GraphPad Software, San Diego, CA, USA), based on data from a prior study, which reported group means of 2.08 and 0.79 with SDs of 1.85 and 0.69, respectively, corresponding to an effect size (Cohen's d) of 0.924. Using a significance level (α) of 0.05 and a desired power of 0.80, the estimated sample size required was 20 participants per group . To account for potential data loss during biochemical analyses, at least 50 participants were recruited per group.

Demographic data and periodontal parameters were compared between groups using GraphPad Prism version 10. Normality of the data was assessed using the Shapiro–Wilk test. For categorical variables, the chi-squared test was applied. One-way repeated-measures ANOVA, followed by Bonferroni correction, was used for post-hoc analyses where appropriate. For comparisons involving more than 2 groups, one-way ANOVA was performed to evaluate overall differences, with Tukey's multiple comparison test applied post hoc to control for type 1 error across various comparisons. For predefined comparisons between 2 independent groups within the same dataset, unpaired two-sample *t*-tests with Bonferroni correction were utilized. All statistical tests were two-tailed, and a corrected *P*-value of less than .05 was considered statistically significant.

To assess the symmetry between paired dependent variables, statistical analyses were conducted using Python (version 3.13). For each dataset (non-periodontitis and periodontitis groups), agreement between left mandible and right mandible categorical classifications (ordinal scale: Grade 0-3) was evaluated using Bowker's Test of Symmetry to detect directional asymmetry. Cohen's Kappa coefficient was calculated to quantify the degree of categorical agreement. Post-hoc exact binomial tests identified specific class pairings exhibiting directional disagreement (asymmetry). A significance threshold of α=0.05 was applied.

RESULTS

A total of 110 participants were categorized into 2 primary groups based on periodontal status: non-periodontitis (including periodontally healthy [n=6] and gingivitis [n=53]) and periodontitis (comprising Stage I [n=11], Stage II [n=14], Stage III [n=13], and Stage IV [n=13]). Table 1 presents the comparison of demographic and clinical periodontal parameters across these groups.

When grouped as periodontitis vs. non-periodontitis, significant differences were observed across all clinical parameters (Table 2). Participants in the periodontitis group were significantly older than those without periodontitis (49.33 ± 10.45 vs. 32.93 ± 11.04 years; $P < .0001$). Although the gender distribution did not differ significantly (P=.124), a slightly

Table 1. Comparison of Demographic and Clinical Periodontal Parameters Between the Groups According to Stages

Varibles	Periodontally Healthy (n = 6)	Gingivitis (n = 53)	Stage I Periodontitis (n = 11)	Stage II Periodontitis (n = 14)	Stage III Periodontitis (n = 13)	Stage IV Periodontitis (n = 13)	*P*
Age (years)	27.17 ± 7.20	33.58 ± 11.26	48.18 ± 8.35	50.21 ± 9.11	44.31 ± 12.66	54.38 ± 9.74	**<.0001**
	26.50 (18.00-35.00)	30.00 (18.00-63.00) *	48.00 (39.00-61.00) *β	49.00 (36.00-70.00) *β	47.00 (20.00-61.00) *β	51.00 (37.00-75.00) *β	
Gender (F/M)	3/3	35/18	9/2	7/7 *	3/10	6/7	**.036**
PD (mm)	2.45 ± 0.27	2.45 ± 0.16	2.88 ±0.29	2.94 ±0.35	3.08 ±0.26	3.29 ± 0.27	**<.0001**
	2.33 (2.24-2.8)	2.45 (2.14-2.80) *	2.75 (2.60-3.44) *β	2.90 (2.45-3.88) *β	3.00 (2.84-3.75) *β	3.24 (2.90-2.76) *β♣d	
BOP (%)	7.43 ± 2.12	22.85 ± 9.06	39.01 ± 14.49	44.67 ± 9.27	42.47 ± 11.20	49.06 ± 10.41	**<.0001**
	7.80 (5.00-9.25)	24.00 (15.00-56.70) *	40.00 (15.00-60.00) *β	45.00 (25.00-56.00) *β	40.00 (25.00-62.50) *β	45.00 (35.00-68.80) *β	
CAL (mm)	0.24 ± 0.40	0.29 ± 0.15	2.66 ± 0.25	2.74 ± 0.27	3.07 ± 0.30	3.70 ± 0.37	**<.0001**
	0.05 (0.00-1.00)	0.00 (0.00-1.040)	2.65 (2.35-3.00) *β	2.70 (2.40-3.20) *β	3. 00 (2.50-3.50) *β♣	3.80 (2.50-3.50) *β♣α	
Tooth loss (n)	0.00 ± 0.00	0.84 ± 1.17	1.73 ± 1.27	1.07 ± 1.27	2.85 ± 1.77	6.00 ± 2.35	**<.0001**
	0.00(0.00-0.00)	0.00 (0.00-4.00)	2.00 (0.00-3.00)	1.00 (0.00-4.00)	3.00 (0.00-6.00) *β♣δ	6.00 (2.00-11.00) *βδα	

One-way ANOVA used. Values are presented as mean ± SD and median (min-max). Bold values indicate statistically significant differences (P < .05). P
BOP, bleeding on probing; CAL, clinical attachment level; F, female; M, male; PD, probing depth.
*Statistically significant difference with the periodontally healthy group.
β Statistically significant difference with the gingivitis group.
♣ Statistically significant difference with the Stage I Periodontitis group.
δ Statistically significant difference with the Stage II Periodontitis group.
α Statistically significant difference with the Stage III Periodontitis group.

Table 2. Comparison of Demographic and Clinical Periodontal Parameters Between the Groups

Variables	Non-Periodontitis (n = 59)	Periodontitis (n = 51)	*P*
Age (years)	32.93 ± 11.04 30.00 (18.00-63.00)	49.33 ± 10.45 50.00 (20.00-75.00)	**<.0001**
Gender (F/M)	28/21	25/26	.124
PD (mm)	2.45 ± 0.17 2.44 (2.14-2.80)	3.06 ± 0.33 3.00 (2.45-3.88)	**<.0001**
BOP (%)	21.28 ± 9.81 20.00 (5.00-56.70)	44.01 ± 11.55 45.00 (15.00-68.80)	**<.0001**
CAL (mm)	0.16 ± 0.30 0.00 (0.00-1.04)	3.05 ± 0.51 3.00 (2.35-4.12)	**<.0001**
Tooth loss (n)	0.76 ± 1.14 0.00 (0.00-4.00)	2.92 ± 2.56 2.00 (0.00-11.00)	**<.0001**

Student-*t* test used. Values are presented as mean ± SD and median (min-max). Statistical significance is *P* < .05.
BOP, bleeding on probing; CAL, clinical attachment level; F, female; M, male; PD, probing depth.

higher proportion of males was observed in the periodontitis group. Tooth loss was also more pronounced in this group (2.92 ± 2.56 vs. 0.76 ± 1.14; *P* < .0001).

Age showed a significant increase with periodontal disease severity (*P* < .0001), with participants in Stage III and IV periodontitis being significantly older than those in the healthy, gingivitis, and Stage I groups (*P* < .05). Gender distribution also varied significantly across disease stages (*P* = .036), with male dominance in more advanced stages.

As expected, all clinical periodontal parameters, PD, BOP, and CAL, deteriorated progressively with increasing disease severity (*P* < .0001). The most severe values were observed in Stage III and IV periodontitis. Tooth loss followed the same trend: no tooth loss was recorded in the healthy group, whereas Stage IV participants experienced a mean loss of 6.00 ± 2.35 teeth (*P* < .0001).

Table 3 presents the distribution of mandibular bone apposition grades by periodontal status and side. On the left side, G0 (no apposition) was significantly more common in individuals without periodontitis, while G2 was more prevalent in the periodontitis group. On the right side, only G2 showed a significant difference, with a more frequent occurrence among periodontitis patients.

Bowker's test of symmetry revealed a statistically significant asymmetry between left and right mandible classifications in the non-periodontitis group (χ^2 = 13.87, df = 6, *P* = .031). The agreement between sides was moderate, as indicated by Cohen's Kappa coefficient of 0.430. Post-hoc binomial tests revealed a significant directional asymmetry between G0 and G1 (*P* = .0078), while other category pairs did not reach significance (Figure 1).

In contrast, Bowker's test for the periodontitis group did not reveal significant asymmetry between sides (χ^2 = 8.14, df = 6,

Table 3. Comparison of Bruxism Classification Between the Groups

	Left Side			Right Side		
	Non-Periodontitis	Peridontitis		Non-Periodontitis	Peridontitis	
Varibles	(n=59)	(n=51)	***P***	(n=59)	(n=51)	*P*
Grade 0	10	1	**.009**	18	9	.118
Grade 1	28	22	.65	27	15	.0784
Grade 2	9	16	**.0443**	6	15	**.0104**
Grade 3	12	12	.6862	8	12	.1764

Chi-square test used. Values are presented as mean ± SD and median (min-max). Bold values indicate statistically significances (P < .05).

P = .2278), despite a moderate level of agreement (κ = 0.430). Post-hoc analyses confirmed that none of the category pairs showed statistically significant directional asymmetry (all P > .05) (Figure 2).

DISCUSSION

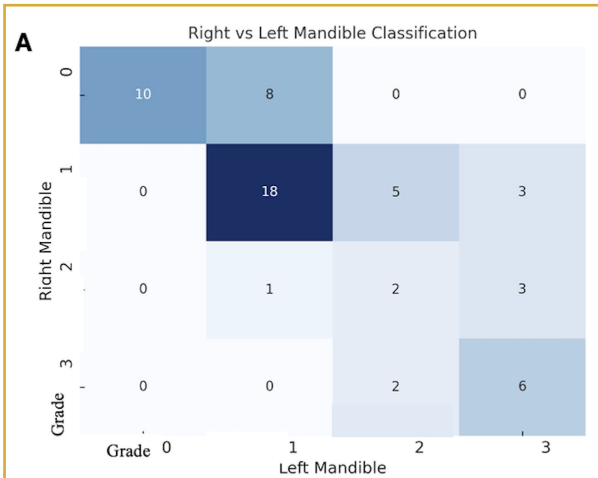
This study examined the distribution and symmetry of mandibular bone appositions in individuals with BR, both with and without periodontitis. The findings suggest that the severity of periodontal disease is associated with distinct patterns of bone adaptation in the mandibular region.

The 2018 International Consensus on the Assessment of Bruxism states that BR diagnosis relies on both extraoral and intraoral examinations. Extraoral assessments include evaluating masseter muscle pain and hypertrophy, whereas intraoral assessments concentrate on signs such as tooth wear, the presence of linea alba on the buccal mucosa, and repeated restoration failures. Identifying at least 2 of these clinical signs is considered adequate for diagnosing BR.[8,19] All participants in this study met these criteria, consistent with prior literature.

As expected, worsening periodontal status was accompanied by a progressive worsening of clinical parameters, such as PD, CAL, and BOP, aligning with the known pathophysiology of periodontitis.[18,20] The substantial rise in tooth loss among participants with Stage III and IV periodontitis highlights the ongoing impact of untreated or severe periodontal damage.

Simultaneously, individuals who have both periodontitis and BR exhibited more severe clinical parameters, greater tooth loss, and older age. These results align with earlier research exploring the relationship between periodontal status and BR.[21] Another study examining the relationship between periodontal status and BR emphasized that BR alone cannot be the cause of periodontal disease and showed that periodontal tissue destruction is not more severe in patients with BR.[19] This may be due to the protective and adaptive capacity of the periodontal ligament and alveolar bone, which respond to excessive occlusal forces. However, there is a lack of studies specifically assessing bone adaptations in the mandible in response to BR in patients with periodontitis.

The analysis of mandibular bone apposition revealed that higher apposition grades (G2 and G3) were significantly more prevalent in individuals with periodontitis. This trend may indicate chronic functional overload on bone that is already inflamed and structurally compromised. According to Wolff's law, bone remodels in response to mechanical stimuli,[22] and these findings imply that this adaptation

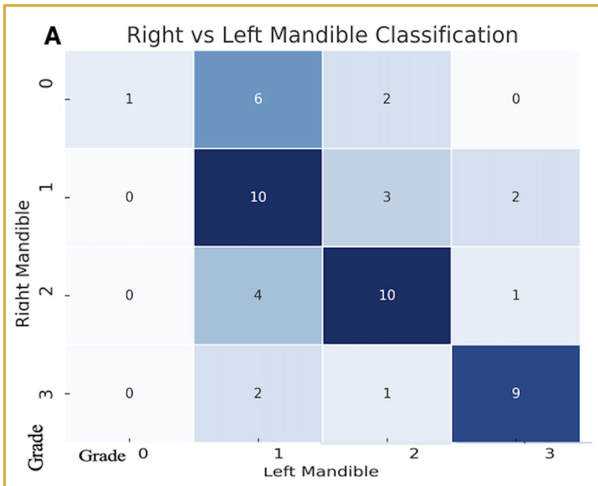


B

Category Pair	b (i ≠ j)	c (j ≠ i)	Total	p-value
Grade 0 vs 1	8	0	8	**0.0078**
Grade 1 vs 2	5	1	6	0.2188
Grade 1 vs 3	3	0	3	0.2500
Grade 2 vs 3	3	2	5	1.0000

- b (i ≠ j): Number of cases where Right Mandible = Grade i and Left Mandible = Grade j.
- c (j ≠ i): Number of cases where Right Mandible = Grade j and Left Mandible = Grade i.
- i and j represent category labels where i ≠ j.
• Bowker's test: χ^2 = 13.87, df = 6, p = 0.031 → Statistically significant asymmetry.
• Cohen's Kappa = 0.430 → Moderate agreement.
- Significant asymmetry is indicated when b and c differ significantly (binomial test).

Figure 1. Paired comparison of the non-periodontitis group for mandible classification.



B

Category Pair	b (i≠j)	c (j≠i)	Total	*p*-value
Grade 0 vs 1	6	0	6	0.0312
Grade 0 vs 2	2	0	2	0.5
Grade 1 vs 2	3	4	7	1.0
Grade 1 vs 3	2	2	4	1.0
Grade 2 vs 3	1	1	2	1.0

- b (i ≠ j): Number of cases where Right Mandible = Grade i and Left Mandible = Grade j.
- c (j ≠ i): Number of cases where Right Mandible = Grade j and Left Mandible = Grade i.
- i and j represent category labels where i ≠ j.
• Bowker's test: $\chi^2 = 8.14$, df = 6, p = 0.2278 → No statistically significant asymmetry.
• Cohen's Kappa = 0.430 → Moderate agreement.
- All paired category comparisons yielded non-significant results ($p > 0.05$), indicating no statistically significant directional asymmetry (binomial tests).

Figure 2. Paired comparison of the periodontitis group for mandible classification.

continues even amid inflammation, though its distribution and symmetry may change. However, the existing literature on bone adaptation is inconsistent. Multiple studies have found similar correlations, reinforcing the notion that chronic occlusal loading, particularly in individuals with BR, may lead to morphological changes in the mandibular bone's architecture and have reported increased bone apposition at the mandibular angle in bruxist patients, as shown in panoramic radiographs.[4,11,23] However, some research has failed to establish these connections, and they found no significant differences in trabecular bone patterns between bruxists and non-bruxists using advanced radiographic analysis.[24,25] These discrepancies may arise from differences in BR diagnostic criteria, radiographic methods, anatomical landmarks evaluated, and study population characteristics. Collectively, the varying results underscore the importance of standardized assessment protocols and longitudinal data in enhancing the understanding of how functional loading influences periodontal breakdown and skeletal adaptation. Furthermore, earlier research has revealed only a minor link between BR and periodontal health, suggesting that while BR may influence bone morphology, its direct effects on periodontal disease remain ambiguous.[26]

The results of this study align with previous reports that associate BR with radiographic evidence of mandibular cortical thickening or bone projection, particularly in the gonial region. However, few studies have stratified such findings based on periodontal status.[19,21,27] This study contributes to the limited evidence suggesting that the interplay between parafunctional activity and periodontal status can influence not only the presence but also the pattern and symmetry of bone adaptation.

The asymmetry analysis revealed a statistically significant difference between G0 and G1 apposition grades in individuals with non-periodontitis unilaterally. In contrast, the periodontitis group did not exhibit this pattern; their bone apposition was generally more bilaterally distributed and characterized by more pronounced higher-grade changes. One possible explanation for this is that, in the absence of periodontitis, BR-induced forces may exert a more localized effect, resulting in asymmetric bone adaptation and a tendency toward unilateral bone apposition, particularly on the dominant chewing or loading side. Conversely, when periodontitis is present, widespread inflammatory changes can trigger a more uniform and symmetric bone response. Additionally, individuals with periodontitis often exhibit greater occlusal instability due to attachment loss and tooth migration, which may further contribute to more diffuse and symmetric loading patterns, thus promoting bilateral adaptation. In contrast, structurally stable periodontal tissues in individuals without periodontitis may localize force vectors, limiting the bone response to 1 side.

Identifying advanced mandibular bone apposition in patients with BR and periodontitis could provide valuable diagnostic and prognostic insights. Radiographic evidence of bone apposition, especially in the gonial regions, may serve as an indirect indicator of chronic occlusal overload among bruxist individuals. When these findings coexist with clinical signs of periodontitis, they may reflect not just a history of mechanical stress but also the bone's adaptive response to compromised periodontal support.

Although this study has shown a strong relationship between periodontitis, chewing function, and BR-related changes in the bone structure, it also has some limitations. First, its cross-sectional design limits causal inference regarding the interplay between BR, periodontitis, and mandibular bone adaptation. Second, the diagnosis of BR was based on clinical and self-report criteria rather than polysomnographic confirmation. Third, the reliance on panoramic radiographs, while practical, limits dimensional accuracy compared to Cone Beam Computed Tomography (CBCT). Furthermore, anatomical variations in the mandibular angle could influence radiographic interpretations. Further longitudinal studies are necessary to explore potential causal relationships between the direction of occlusal forces and patterns of bone adaptation.

CONCLUSION

In conclusion, this study provides preliminary evidence that mandibular bone adaptation is influenced by both BR and periodontal status. Individuals with BR and periodontitis exhibited more extensive and symmetric bone apposition, whereas those without periodontitis tended to show milder, unilateral adaptation.

The results suggest that parafunctional forces and periodontal inflammation may act in concert to influence bone remodeling in the mandible. Further research utilizing longitudinal designs, consistent BR evaluations, and advanced imaging methods is essential to clarify the temporal dynamics and clinical significance of mandibular bone adaptation in bruxist patients with varying periodontal health conditions.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Ankara Medipol University (Approval No.: E-85859696-604.01.01-3467; Date: April 30, 2025).

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