Research Article



# Evaluating the Effects of Orthodontic Banding on Gingival Health: A Six-Months Study

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# Abstract

**Objective:** To evaluate the effect of orthodontic banding on gingival health parameters in patients receiving fixed orthodontic treatment, from the time of band cementation up to six months post-treatment.

**Material and Methodology:** The study was conducted on 30 participants, aged between 12 – 35 years from both genders needed fixed orthodontic treatment. The upper first molar was banded. Participants received instructions for proper oral hygiene and balanced dietary habits. The gingival parameters including Gingival Margin, probing depth, Gingival Index, bleeding on probing and Plaque Index were assessed and examined from the time of band cementation up to six months posttreatment.

**Results:** Statistical analysis Repeated measure ANOVA (Paired Sample Test) was used to analyze the data. Indicated that, there are significant differences when using cemented bands on gingival health parameters with duration.

**Conclusion:** The use of cemented bands for molar teeth during fixed orthodontic treatment has significant differences on gingival health parameters as it can influence these parameters at short rang.

Keywords: Fixed Orthodontics; Gingival Parameters; Cemented Bands; Molar

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Orthodontic banding, a crucial step in fixed orthodontic appliance treatment, ensures proper retention and resistance of the appliance against orthodontic forces. This is particularly important for molars, which endure significant forces during treatment. In orthodontics, attachments can be either banded as orthodontic bands or bonded as orthodontic tubes. Orthodontic appliances form a network in the dentition, which might exacerbate food stagnation [1]. The use of bands in fixed orthodontic equipment has grown in popularity due to the necessity for stability when using functional and orthopedic appliances such as headgear or facemasks, as well as lingual attachments like the transpalatal arch. Molar banding is a tried-and-true orthodontic technique that ensures proper retention and resistance to orthodontic forces. While advancements in adhesive solutions have made bonding attachments to molars commonplace, reducing clinical care time and improving oral hygiene [2]. Many orthodontists still prefer molar bands. This preference is driven by the belief that molar bands have lower failure rates and offer greater reliability [3]. With advancements in band design (mechanical retention mechanisms, micro-etching). Gingival health may be negatively impacted by the positioning of orthodontic bands, which are required to cover a significant portion of the tooth's surface and pierce deeply into the gingival sulcus to increase retention. Plaque buildup might result from using fixed equipment while disregarding appropriate dental hygiene guidelines. Gingivitis develops as a result of the detrimental alterations in microbiota caused by the plaque buildup accelerated by orthodontic appliances [4]. If inadequately managed, it may progress to periodontitis. Several factors can exacerbate gingival irritation when using orthodontic bands. Mechanical irritation of the gingival tissues, chemical irritation from the cement used, increased food impaction risk, and patients' tendency to clean anterior teeth more thoroughly than posterior teeth all play a role. Orthodontic treatment is a dual-action procedure affecting periodontal tissues, which can significantly enhance periodontal health or, conversely, lead to various periodontal disorders [5]. Atack et al., 1996 describes four reasons for increasing gingival inflammation with orthodontic bands [6]. These reasons come from irritation to gingival tissues, from cement used to band placement as it is cemented near to gingiva, increase risk of food stagnation and ability for participants to clean their anterior teeth better than posteriors.

This study aimed to evaluate the effect of orthodontic banding on gingival health parameters in patients receiving fixed orthodontic treatment, from the time of band cementation up to six months post-treatment

#### Material and Methodology

Selection of Patients came to our clinic from 05.03.2024 to 04.05.2024 which they 30 participants aged between 12 to 35 years, 11 adolescent and 19 adults from both genders 8 male and 22 female who had just commenced orthodontic treatment with fixed appliances. This study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Palestinian Health Research Council and the Ethics Committee approved the protocol of PHR-C/HC/1169/24. And all participants provided written informed consent prior to their inclusion in the study. The Participants chosen according to the eligibility criteria, patients who are currently free of periodontitis, have not previously undergone orthodontic treatment, without underlying systemic diseases, non-pregnant females, and fall within the age range of 12 to 35 years old are included in the sample. Conversely, patients with missing maxillary first molars, those needing arch expansion or molar distalization, and individuals with systemic diseases are excluded from participation. Prior to cementing the molar band to one upper first molar, an assessment was conducted to evaluate gingival health parameters. This evaluation included measurements of the gingival margin, gingival index, plaque index and probing depth. This initial assessment was denoted as "T0." Subsequently, fixed orthodontic appliances were conventionally bonded using American orthodontic brackets, extending from the second premolar to the opposing second premolar. The upper first molar was fitted with a 3Mstyle metal band and cemented by Riva self-cure glass ionomer luting cement (SDI trademark). Participants were provided with comprehensive instructions emphasizing proper oral hygiene practices and maintaining a balanced diet with reduced sugar consumption to ensure a consistent environment during the study. After three months from the initial assessment (T0), a follow-up assessment of gingival parameters for the upper first molar was conducted and denoted as "T3." Similarly, the same assessment was repeated six months from the start of treatment, denoted as "T6." The using of bands especially molars are to strengthen the anchorage, bands wrap around the tooth so it's hard to come off under masticatory forces compared to bonds, on the other hand, bands is suitable for auxiliaries attachments as arch wire, headgear and face mask and also sometimes bands used due to difficulty for molar bonding especially with partially erupted molars.

#### **Clinical Evaluation**

Gingival parameters were assessed through clinical examinations. A calibrated examiner conducted the assessments using a University of Michigan O probe with William's markings. International indices were utilized for measurement, and a standardized periodontal diagnostic chart was employed to document the data.

#### **Scoring Criteria**

The following indexes used to measure the gingi-

val parameters [7].

- Miller's classification for gingival recession and Millers and Damm classification for gingival enlargement was used to measure the gingival margin, in case of gingival recession used (-) before the number and in case of gingival enlargement used (+) before the number.
- The Loe & Silness (1963) scheme was used to measure gingival index and Silness & Loe (1964) scheme was employed to measure the Plaque index.
- Probing depth was measured using The University of Michigan O probe with Williams markings, recording the distance from the gingival margin to the deepest part of the sulcus. Six readings were taken per tooth at specific locations.

# Results: Gingival parameters attributed to duration for cemented bands

Gingival margin index: Repeated Measure ANOVA

Paired Samples Statistics									
		Mean	N	Std. Deviation	Std. Error Mean				
Pair 1	Gingival Margin T0	.0000	30	.00000	.00000				
	Gingival Margin T3	.0333	30	.18257	.03333				
Pair 2	Gingival Margin T3	.0333 <sup>°</sup>	30	.18257	.03333				
	Gingival Margin T6	.0333 <sup>°</sup>	30	.18257	.03333				
Pair 3	Gingival Margin T0	.0000	30	.00000	.00000				
	Gingival Margin T6	.0333	30	.18257	.03333				
a	a. The correlation and t cannot be computed because the standard error of the difference is 0.								

#### **Table 1:** Gingival Margin attributed to duration for cemented bands

From the previous table, the significance level value (P = 0.326 > 0.05) indicates that there are no statistically

significant differences in the level of Gingival margin according to the duration of cemented bands using T0, T3 and T6 months.



Figure 1: Descriptive statistics for Gingival marginal readings for cemented bands from T0 - T6

Paired Samples Test										
	Paired Differences								Sig. (2- tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	Gingival Margin T0 - Gingival Margin T3	03333	.18257	.03333	10151	.03484	-1.000	29	.326	
Pair 3	Gingival Margin T0 - Gingival Margin T6	03333	.18257	.03333	10151	.03484	-1.000	29	.326	

Table 2: Source of differences for Gingival Margin

From the previous table, there is no statistically significant differences regarding Gingival Margin as (P = 0.326 > 0.05).

#### Plaque index: Repeated Measure ANOVA



Figure 2: Descriptive statistics for Plaque Index readings for cemented bands from T0 - T6

Paired Samples Statistics									
		Mean	N	Std. Deviation	Std. Error Mean				
Pair 1	Plaque Index T0	.0000	30	.00000	.00000				
	Plaque Index T3	.8333	30	.87428	.15962				
Pair 2	Plaque Index T3	.8333	30	.87428	.15962				
	Plaque Index T6	1.1667	30	.74664	.13632				
Pair 3	Plaque Index T0	.0000	30	.00000	.00000				
	Plaque Index T6	1.1667	30	.74664	.13632				

Table 3: Plaque index attributed to duration for cemented bands

From the previous table, the significances level value (P = 0.000 < 0.05) indicated that there is statistically significant differences in the level of Plaque index according to the duration of cemented bands using T0, T3 and T6 months therfore, In order to identify the source of the differences, the compare means paired-samples T Test was used.

					_						
	Paired Samples Test										
			Paired Differences						Sig. (2- tailed)		
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference						
					Lower	Upper					
Pair 1	Plaque Index T0 - Plaque Index T3	83333	.87428	.15962	-1.15980	50687	-5.221	29	.000		
Pair 2	Plaque Index T3 - Plaque Index T6	33333	.80230	.14648	63292	03375	-2.276	29	.030		
Pair 3	Plaque Index T0 - Plaque Index T6	-1.16667	.74664	.13632	-1.44547	88787	-8.558	29	.000		

**Table 4:** Source of differences for Plaque index (1)

From the previous table, there is statistically significant differences regarding plaque index between T0 - T3 and T6 for the cemented bands. Mean that the best stage where the plaque is minimum at level T0 which is the best

because the difference in plaque index from T0 till T6 = (1.1667-0.8333= 0.3334) as the plaque increased with time for the six months study period.

#### Gingival index: Repeated Measure ANOVA

Paired Samples Statistics									
		Mean	N	Std. Deviation	Std. Error Mean				
Pair 1	Gingival Index T0	1.0000	30	.00000	.00000				
	Gingival Index T3	1.5000	30	.50855	.09285				
Pair 2	Gingival Index T0	1.0000	30	.00000	.00000				
	Gingival Index T6	1.5667	30	.50401	.09202				

**Table 5:** Gingival index attributed to duration for cemented bands

Pair 3	Gingival Index T3	1.5000	30	.50855	.09285
	Gingival Index T6	1.5667	30	.50401	.09202

From previous table, the significance level value (P = 0.000 < 0.05) indicated that there is statistically significant differences in the level of Gingival index according to the

duration of cemented bands using T0, T3 and T6 months therefore, in order to identify the source of the differences, the compare means paired-samples T Test was used.



Figure 3: Descriptive statistics for Gingival Index readings for cemented bands from T0 - T6

Paired Samples Test										
			Paired Differences						Sig. (2- tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper				
Pair 1	Gingival Index T0 - Gingival Index T3	50000	.50855	.09285	68989	31011	-5.385	29	.000	
Pair 2	Gingival Index T0 - Gingival Index T6	56667	.50401	.09202	75487	37847	-6.158	29	.000	
Pair 3	Gingival Index T3 - Gingival Index T6	06667	.52083	.09509	26115	.12781	701	29	.489	

Table 6:	Source of	difference	for	Gingival index	ζ
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From the previous table, there is statistically significant differences regarding gingival index between T0 – T3 and between T0 and T6 for the cemented bands. means that the best stage where the gingival index minimum at level T0 and after that the gingival index changed with time for

around six months because in the middle 3 months between T3 - T6 there is no significant difference between the values. Therefore, the clear difference needs around 6 months to be noticed.

#### Bleeding on probing: using Chi-square Test



Figure 4: Descriptive statistics for Bleeding on Probing readings for cemented bands from T0 – T6 as 1 means bleeding, 2 means no bleeding

Bleeding on Probing T3 * Bleeding on Probing T6 Crosstabulation								
	Bleeding on	Bleeding on Probing T6						
			Y	Ν				
Bleeding on Probing T3	Y	Count	12	3	15			
		% of Total	40.0%	10.0%	50.0%			
	N	Count	5	10	15			
		% of Total	16.7%	33.3%	50.0%			
Total		Count	17	13	30			
		% of Total	56.7%	43.3%	100.0%			

Table 7: Bleeding on Probing attributed to Duration for cemented bands 1

#### Table 8: Bleeding on Probing attributed to Duration for cemented bands 2

Chi-Square Tests							
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)		
Pearson Chi-Square	6.652 <sup>ª</sup>	1	.010				
Continuity Correction	4.887	1	.027				
Likelihood Ratio	6.946	1	.008				
Fisher's Exact Test				.025	.013		
Linear-by-Linear Association	6.430	1	.011				
N of Valid Cases	30						
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.							
b. Computed only for a 2x2 table							

From previous table, there is statistically significant differences regarding Bleeding on probing between T0, T3 and T6 for the cemented bands, means that there is bleeding on probing changes for different stages of study duration.

#### **Probing Depths: Repeated Measure ANOVA**

All the measured 6 points for probing depths were calculated for an average and a Mean was used for the analysis for T0, T3 and T6.



Figure 5: Descriptive statistics for Av. Probing Depths readings for cemented bands from T0 - T6

Paired Samples Statistics									
		Mean	Ν	Std. Deviation	Std. Error Mean				
Pair 1	av_probingdepthT0	1.2556	30	.44953	.08207				
	av_probingdepthT3	1.4861	30	.55237	.10085				
Pair 2	av_probingdepthT0	1.2556	30	.44953	.08207				
	av_probingdepthT6	1.8306	30	.44231	.08075				
Pair 3	av_probingdepthT3	1.4861	30	.55237	.10085				
	av_probingdepthT6	1.8306	30	.44231	.08075				

Table 9: Average of Probing depths attributed to duration for cemented bands

From previous table. There is statistically significant difference regarding probing depth in the (p=

0.000<0.05) between T0-T3 -T6 for the cemented bands. to know the differences, compare means paired-samples T Test was used.

Table 10: Source	of difference	for the average	of Probing depths
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Paired Samples Test												
	Paired Differences					t	df	Sig. (2- tailed)				
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference								
				Lower	Upper							

Pair 1	av_probingdepthT0 - av_probingdepthT3	23056	.15112	.02759	28698	17413	-8.356	29	.000
Pair 2	av_probingdepthT0 - av_probingdepthT6	57500	.41021	.07489	72817	42183	-7.678	29	.000
Pair 3	av_probingdepthT3 - av_probingdepthT6	34444	.45261	.08263	51345	17544	-4.168	29	.000

From previous table, there is statistically significant change in the average of probing depths between T0-T3 and T6. That mean the probing depth for the cemented bands changed from the beginning of the treatment and increased as the duration increased. The mean change in the noticeable between T0 and T6 around (2.3667-1.4333= 0.9334) which is high difference between the two values for a 6 months period.

## Discussion

This study aimed to test the effects of using molar bands on gingival health during fixed orthodontic treatment, focusing on gingival margin, plaque index, gingival index, Bleeding on Probing and probing depth.

The findings indicated that, there is statistically significant differences of using cemented bands on molar teeth during fixed orthodontic treatment for all studied gingival parameters except gingival margin.

The gingival margin p value > 0.05 so that means gingival margin has not any significant change during the 6 months period. So, it's not clear if this can change with increasing study period or not. May can do this in future study.

The study results are matching with a previous study done on 2023, by Amir et Al. to test the effect of orthodontic banding on gingival health of first permanent molars. The findings were Orthodontic banding can adversely affect gingival health in patients receiving fixed appliance treatment. Lack of proper oral hygiene maintenance further aggravates poor gingival health [8]. His study tested the palque index and gingival index only but this study tests other 3 gingival parameters and have the same results that using molar bands adversely affect molar gingival health. Another matching study done on June 2016 to by Shrestha to study the oral health status in patients with fixed orthodontic appliances with molar bands and bonded tubes for Nepalese orthodontic patients, the study found that the use of molar bands and molar tubes can cause progression of gingivitis and there is no significant change in periodontal health parameters in using cemented bands or bonded tubes when oral hygiene is controlled [9]. In 2018, a systematic review and meta-analysis study was done by Papageorgiou et al. to test the effect of orthodontic treatment of periodontal clinical attachments, the findings showed that from longitudinal clinical studies, orthodontic treatment with fixed appliances has little to no clinically relevant effect on periodontal clinical attachments levels and this is not matching with the research results [10]. Another study was done in November 2015, by Al Anezi et al. to test the effect of orthodontic bands or tubes upon periodontal status during the initial phase of orthodontic treatment. The findings of the study showed that molar bands are associated with greater periodontal inflammation compared to molar bonds in the first three months of treatment [11]. These results are matching with research results that gingival bands can affect gingival molar health. Al-Anezi study, the participants were twenty-four in mean age 12.6 years, that's mean the majority of the participants were adolescent young ages, but in this research the sample was thirty patients and the majority of the participants were adults above 18 years, and this approve that this gingival change can occur with any age and associated with orthodontic bands, even this age the participants be cooperative and not careless regarding oral hygiene instructions.

In 2003, Al Hamdany, published an article about changes in gingiva with orthodontically banded and bonded teeth. The results indicated that orthodontic bands would provoke more periodontal changes than brackets. And this also matched with research results, with significant differences in the gingival health parameters with orthodontic bands [12]. Even that, Al Hamdany studied different teeth areas, bands were cemented to upper and lower first molars and rest of teeth bonded by composite. Teeth included in her study were upper right and lower left central incisors and upper left and lower right first molars. The teeth used in her study were in different areas that may alter her results as anterior area where central incisors present is a cleansable area while molars in the posterior area which is less cleansable area. but when we look to molar results we will find it matching with ours.

# Conclusion

The use of cemented bands for molar teeth during fixed orthodontic treatment has significant differences on gingival health parameters as it can influence these parameters at short rang.

So, the orthodontists should make more concern on the gingival health and ensure that patients receive thorough oral hygiene instructions before and during treatment and using fluoride mouth rinses, interdental brushes. Regular periodontal evaluations should be integrated into orthodontic follow-up visits, especially for patients with pre-existing gingival conditions.

# Declarations

## Ethics Approval and Consent to Participate

This study was conducted in full compliance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Palestinian Health Research Council and the Ethics Committee approved the protocol of PHRC/HC/1169/24. And all participants provided written informed consent prior to their inclusion in the study.

## **Consent for Publication**

Not applicable

#### Funding

Not applicable

# **Authors' Contributions**

Not applicable

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