

Original Research

Comparing the changes of periodontal parameters between banded and bonded teeth during fixed orthodontic treatment Among Orthodontic Patients in Gaza strip, Palestine

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ABSTRACT:

Objective: To compare the effect of using molar bands and bonded tubes on the gingival health of upper first molar teeth during the application of fixed orthodontic appliance in Gaza strip, Palestine. **Material and methodology:** The study was conducted on 60 upper first molar teeth from 30 participants, aged between 12 – 35 years from both genders needed fixed orthodontic treatment in Gaza strip. Upper right first molar was banded, while upper left first molar was bonded. Participants received instructions for proper oral hygiene and balanced dietary habits. The gingival parameters including Gingival Margin, Gingival Index, probing depth, and Plaque Index were assessed and examined before molar band and bonded tube placement (T0), three (T3) and six (T6) months of treatment. **Results:** Statistical analysis Independent two sample t- test, indicated there is no significant differences between using cemented bands and bonded tubes. based on the type of orthodontic appliance and different variables. **Conclusion:** Study demonstrates that using molar bands and bonds have significant effect on periodontal parameters, when comparing their performance there is no significant differences.

Keywords: Bonded tube, Fixed orthodontics, Gaza Strip, Gingival index, Molar bands.

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INTRODUCTION

In recent years, there has been a growing demand for orthodontic treatments especially in developed countries.¹Molar bands and bonded tubes are considered as a key part in fixed orthodontic treatment long time ago.

Gaza strip, Palestine is a densely populated area contains about 2.17 million people, who are living in 365 square kilometers.² As most of Arab world, there is a noticeable shortage of research about orthodontic treatment in Gaza strip. besides, there is a paucity of up-to-date data regarding the prevalence of periodontitis in the Arab adult population.³ However, the orthodontic treatment is practiced in many dental

clinics in Gaza, and people are well known about it's importance. They follow it's parameters and advancements through social media and refer to practice doctors asking for the service either for therapeutic or aesthetic purposes.

Fixed orthodontic appliances have become increasingly popular for treating various malocclusions and craniofacial discrepancies around the world. It come with challenges related to oral hygiene difficulties due to the various components involved such as brackets, bands, bonds, wire, and other attachments. These components can make it challenging to maintain optimal oral cleanliness, leading to the accumulation of plaque and subsequent

gingival inflammation, which can range from mild to severe, sometimes even resulting in the appearance of false pockets.⁴ This challenge is particularly pronounced in the posterior region.⁵

The extended presence of fixed orthodontic appliances within the oral cavity has been a subject of increasing interest in orthodontic research. Researchers are keen to uncover the precise relationship between orthodontic treatment and gingival health and whether it has any potential side effects on periodontal health. This topic has emerged as a focal point in recent orthodontic investigations. Whether to band molars or to bond them during orthodontic treatment, has now become a dilemma to many practicing orthodontists.⁶

There are different research results regarding the relation between molar bands and bonded tubes and their effect on the gingival health. One of the researchers' results suggested that molar bands are associated with greater periodontal inflammation compared to molar bands in the first three months.⁷ Other result suggested that the increase in pocket depth showed that plaque deposition leads to periodontal destruction around molar bands, patients' motivation to maintain oral hygiene and regular scaling will minimize hazardous effect.⁸ In regards of using both molar bands and molar tubes results showed that they might cause progression of gingivitis and there is no significant change in periodontal health parameters in using cemented bands or bonded tubes when the oral hygiene is controlled.⁹ Another findings, In patients without pre-existing periodontal issues, research results suggested that the placement of fixed orthodontic appliances has been linked to elevated bacterial plaque buildup and the onset of inflammation could be a result of poor oral hygiene in molar regions and the presence of molar bands and bands which favors food lodgment.¹⁰ Another finding for Gaza strip population that paternal education level is considered a risk factor for gingivitis where the students whose fathers have low educational level have higher probability of complaining for gingivitis than those whose fathers of high educational level.¹¹

There are other effects that might aggravate gingival inflammation in the presence of bands and bonds. Atack, N et.al mentioned four potential factors contributing to increased gingival inflammation in association with orthodontic bands were identified. Firstly, orthodontic bands were found to mechanically irritate the gingival tissues. Secondly, chemical irritation could occur due to the cement used to affix the band, which comes into proximity with the gingival tissues. Thirdly, a higher risk of food getting trapped and subsequently causing irritation to the posterior gingival and periodontal areas was noted. Lastly, patients tended to maintain more effective cleaning habits for their front teeth compared to their posterior teeth.¹²

This research endeavors to compare between the effect of using molar bands and bonded tubes on

gingival health through the fixed orthodontic process. The study involved a sample of sixty teeth from thirty participants aged between 12 to 35 years old from both genders who were seeking orthodontic treatment with a fixed orthodontic appliance. While employing a fixed orthodontic appliance, for each patient, upper right first molar was fitted with an orthodontic band, while the upper left first molar was bonded by a tube to check the difference of their effect on gingival health.

MATERIAL AND METHODOLOGY

Selection of Patients came to our clinic from 05.03.2024 to 04.05.2024 which they are 60 first molar teeth from 30 participants aged between 12 to 35 years 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 PHRC/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 bands or bonding the tubes onto the upper first molars, 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 right first molar was fitted with a 3M-style metal band and cemented by Riva self-cure glass ionomer luting cement (SDI trademark). Meanwhile, the upper left first molar was bonded with an American Orthodontic tube style using GC ortho connect adhesive (GC 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 for both the banded and bonded first molars. After three months from the initial assessment (T0), a follow-up assessment of gingival parameters for the upper first molars (banded and bonded teeth) were conducted and denoted as "T3." Similarly, the same assessment was repeated six months from the start of treatment, denoted as "T6."

Clinical Evaluation

Gingival parameters were assessed through clinical examinations. A calibrated examiner conducted the assessments using a University of Michigan O probe with Williams’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 gingival parameters.¹³

1. 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.

2. The Loe & Silness (1963) scheme was used to measure gingival index and Silness & Loe (1964) scheme was employed to measure the Plaque index.
3. 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.
4. The scoring scheme for Bleeding on probing was (Ainamo and Bay) scheme:

The presence or absence of gingival bleeding is determined by gentle probing of the gingival crevice with a periodontal probe. The appearance of the bleeding within 10 seconds indicates a positive score and marked as (+) means there is bleeding and (-) means there is no bleeding.

RESULTS

1. Comparing the gingival margin for right cemented band and left bonded tube attributed to duration

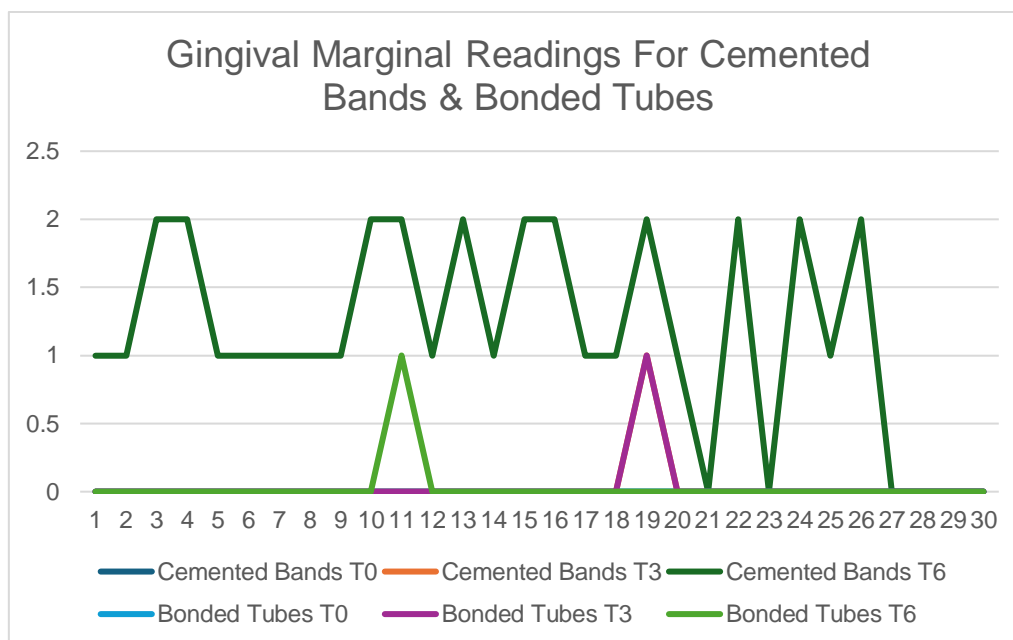


Figure 1. Descriptive statistics for Gingival marginal readings for cemented bands and bonded tubes from T0 – T6

Table 1. Comparing the gingival margin for right cemented band and left bonded tube attributed to duration (1)

Group Statistics					
	type	N	Mean	Std. Deviation	Std. Error Mean
Gingival Margin T0	Band	30	.0000	.00000 ^a	.00000
	Tube	30	.0000	.00000 ^a	.00000
Gingival Margin T3	Band	30	.0333	.18257	.03333
	Tube	30	.0333	.18257	.03333
Gingival Margin T6	Band	30	.0333	.18257	.03333
	Tube	30	.0333	.18257	.03333

a. t cannot be computed because the standard deviations of both groups are 0.

Table 2. Comparing the gingival margin for right cemented band and left bonded tube attributed to duration (2)

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Gingival Margin T3	Equal variances assumed	.000	1.000	.000	58	1.000	.00000	.04714	-.09436	.09436
	Equal variances not assumed			.000	58.000	1.000	.00000	.04714	-.09436	.09436
Gingival Margin T6	Equal variances assumed	.000	1.000	.000	58	1.000	.00000	.04714	-.09436	.09436
	Equal variances not assumed			.000	58.000	1.000	.00000	.04714	-.09436	.09436

From the above table we conclude that there is no statistically significant difference between cemented bands and bonded tubes for gingival margin among T0, T3 & T6 because P. value=1.0

2. Comparing the Plaque index for right cemented band and left bonded tube attributed to duration.

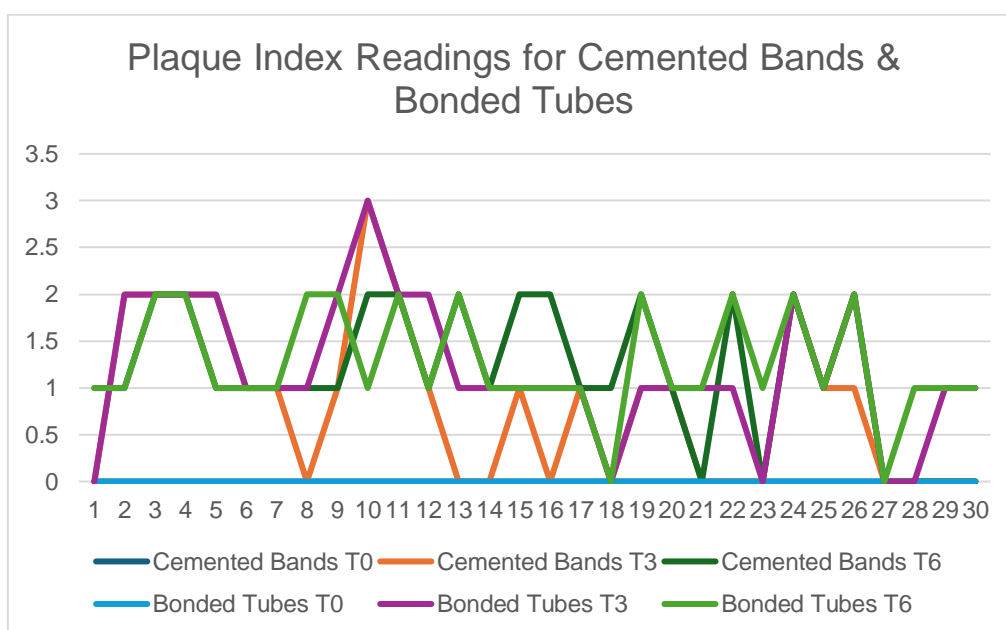


Figure 2. Descriptive statistics for Plaque Index readings for cemented bands and bonded tubes from T0 – T6

Table 3. Comparing the Plaque index for right cemented band and left bonded tube attributed to duration (1)

Group Statistics					
	type	N	Mean	Std. Deviation	Std. Error Mean
Plaque Index T0	Band	30	.0000	.00000 ^a	.00000
	Tube	30	.0000	.00000 ^a	.00000
Plaque Index T3	Band	30	.8333	.87428	.15962
	Tube	30	1.2000	.76112	.13896
Plaque Index T6	Band	30	1.1667	.74664	.13632
	Tube	30	1.2667	.58329	.10649

a. t cannot be computed because the standard deviations of both groups are 0.

Table 4. Comparing the Plaque index for right cemented band and left bonded tube attributed to duration (2)

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Plaque Index T3	Equal variances assumed	1.038	.312	-1.733	58	.088	-.36667	.21163	-.79030	.05697
	Equal variances not assumed			-1.733	56.920	.089	-.36667	.21163	-.79047	.05714
Plaque Index T6	Equal variances assumed	1.697	.198	-.578	58	.565	-.10000	.17298	-.44626	.24626
	Equal variances not assumed			-.578	54.791	.566	-.10000	.17298	-.44670	.24670

From the above table we conclude that there is no statistically significant difference between cemented bands and bonded tubes for Plaque index among T0, T3 & T6 because P. value=0.2

3. Comparing the gingival index for right cemented band and left bonded tube attributed to duration.

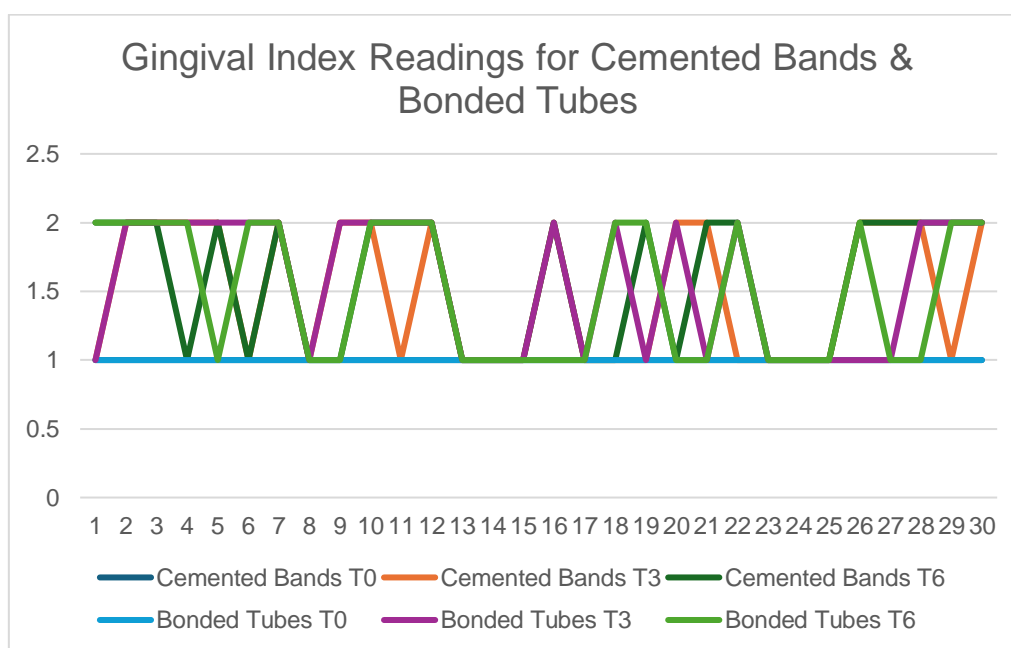


Figure 3. Descriptive statistics for Gingival Index readings for cemented bands and bonded tubes from T0 – T6

Table 5. Comparing the gingival index for right cemented band and left bonded tube attributed to duration (1)

Group Statistics					
	type	N	Mean	Std. Deviation	Std. Error Mean
Gingival Index T0	Band	30	1.0000	.00000 ^a	.00000
	Tube	30	1.0000	.00000 ^a	.00000
Gingival Index T3	Band	30	1.5000	.50855	.09285
	Tube	30	1.5667	.50401	.09202
Gingival Index T6	Band	30	1.5667	.50401	.09202
	Tube	30	1.5000	.50855	.09285

a. t cannot be computed because the standard deviations of both groups are 0.

Table 6. Comparing the gingival index for right cemented band and left bonded tube attributed to duration (2)

		Independent Samples Test									
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
										Lower	Upper
Gingival Index T3	Equal variances assumed	.525	.472	-.510	58	.612	-.06667	.13072	-.32833	.19500	
	Equal variances not assumed			-.510	57.995	.612	-.06667	.13072	-.32833	.19500	
Gingival Index T6	Equal variances assumed	.525	.472	.510	58	.612	.06667	.13072	-.19500	.32833	
	Equal variances not assumed			.510	57.995	.612	.06667	.13072	-.19500	.32833	

From the above table we conclude that there is no statistical difference between cemented bands and bonded tubes for gingival index among three time because P.value=1.0

4. Comparing the bleeding on probing for right cemented band and left bonded tube attributed to duration – Chi-square test

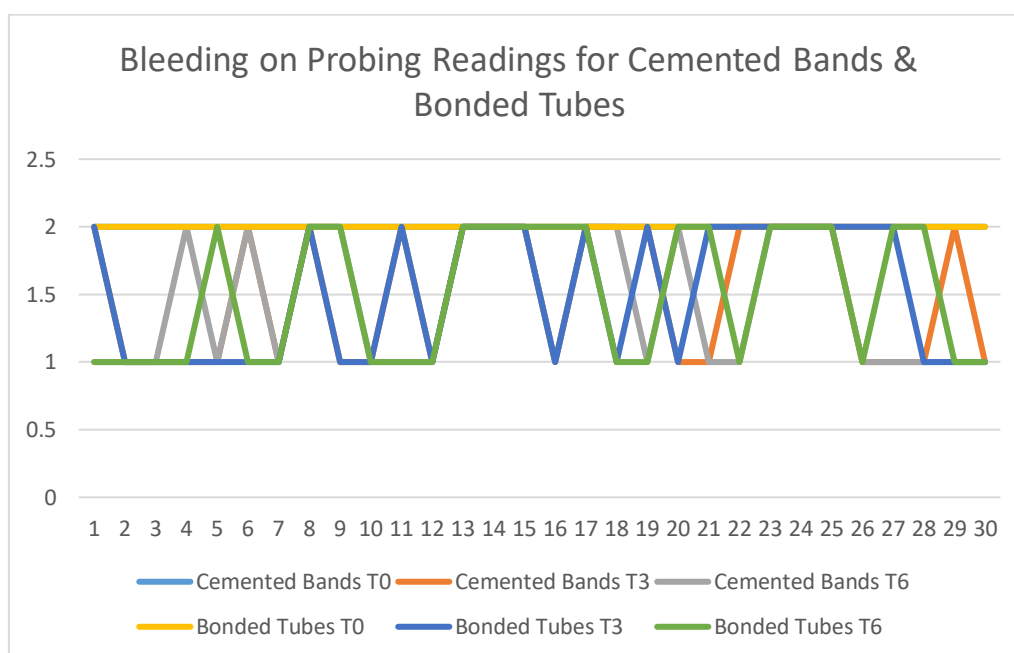


Figure 4. Descriptive statistics for Bleeding on Probing readings for cemented bands and bonded tubes from T0 – T6 as 1 means bleeding, 2 means no bleeding

Table 7. Comparing the bleeding on probing for right cemented band and left bonded tube attributed to duration – Chi-square test (1)

		Crosstab			
		Bleeding on Probing T6		Total	
		Y	N		
type	Band	Count	17	13	30
		% of Total	28.3%	21.7%	50.0%
	Tube	Count	15	15	30
		% of Total	25.0%	25.0%	50.0%
Total		Count	32	28	60
		% of Total	53.3%	46.7%	100.0%

Table 8. Comparing the bleeding on probing for right cemented band and left bonded tube attributed to duration – Chi-square test (2)

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.268 ^a	1	.605		
Continuity Correction ^b	.067	1	.796		
Likelihood Ratio	.268	1	.605		
Fisher's Exact Test				.796	.398
Linear-by-Linear Association	.263	1	.608		
N of Valid Cases	60				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 14.00.
 b. Computed only for a 2x2 table

From the above table we conclude that there is no statistical difference between cemented bands and bonded tubes for bleeding in probing among three time because P.value=0.754

5. Comparing the average of probing depth for right cemented band and left bonded tube attributed to duration

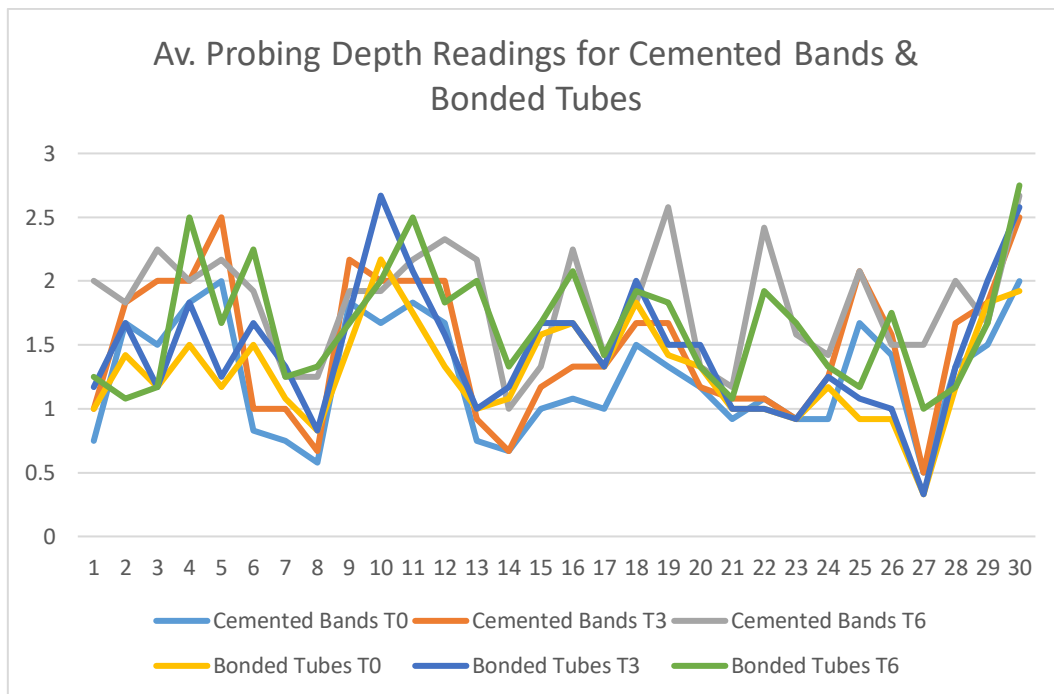


Figure 5. Descriptive statistics for Bleeding on Probing readings for cemented bands and bonded tubes from T0 – T6

Table 9. Comparing the average of probing depth for right cemented band and left bonded tube attributed to duration (1)

Group Statistics					
	type	N	Mean	Std. Deviation	Std. Error Mean
Average Probing Depth T0	Band	30	1.2556	.44953	.08207
	Tube	30	1.2944	.38886	.07100
Average Probing Depth T3	Band	30	1.4861	.55237	.10085
	Tube	30	1.4444	.50635	.09245
Average Probing Depth T6	Band	30	1.8306	.44231	.08075
	Tube	30	1.6528	.46273	.08448

Table 10. Comparing probing depth mesiobuccally for right cemented band and left bonded tube attributed to duration (2)

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Average Probing Depth T0	Equal variances assumed	2.259	.138	-.358	58	.721	-.03889	.10852	-.25611	.17833
	Equal variances not assumed			-.358	56.822	.721	-.03889	.10852	-.25621	.17843
Average Probing Depth T3	Equal variances assumed	1.330	.254	.305	58	.762	.04167	.13681	-.23219	.31552
	Equal variances not assumed			.305	57.566	.762	.04167	.13681	-.23223	.31556
Average Probing Depth T6	Equal variances assumed	.000	.984	1.521	58	.134	.17778	.11687	-.05616	.41172
	Equal variances not assumed			1.521	57.882	.134	.17778	.11687	-.05617	.41173

From the above table we conclude that there is no statistical difference between cemented bands and bonded tubes for Probing depth among three time because P. value=1.0

DISCUSSION

This study aimed to compare the effects of using molar bands and bonded tubes 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 no statistically significant differences between the effect of using cemented bands and bonded tubes when comparing their effect on gingival health parameters as both can influence these parameters at short rang. This is matching with a previous study done on June 2016 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

Other study 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 bands in the first three months of treatment.⁷ These results mismatch with research results as the research results were, no difference between using molar bands and bonds in the period of 3 months or even in 6 months on the gingival health. This difference may be due to sample size and age. As in Al-Anezi study, the participants was 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, that give an indication that majority of the participants was educated, more cooperative and not careless regarding oral hygiene instructions because they are elder in age than Al-Anezi participants.

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. This is mismatching with research results, the research results have no significant differences in the gingival health parameters between band and bonds, this mismatching may be due to Al Hamdany study done for 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. Different teeth used in their study and different areas may alter the results as anterior area where central incisors present is a cleansable area while molars in the posterior area which is less cleansable area. But in this research, the area for cemented bands and bonded tubes is the posterior area and all the environmental factors are the same.¹⁴

CONCLUSION

Oral health is an important concern in fixed orthodontic patients. The use of cemented bands and bonded tubes for molar teeth during fixed orthodontic treatment have no significant differences between their effect on gingival health parameters as both can influence these parameters at short rang.

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