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Tesis Doctoral

Comparing the changes of periodontal parameters when using banded and bonded teeth during fixed orthodontic treatment

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Comparing the changes of periodontal parameters when using banded and bonded teeth during fixed orthodontic treatment

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PROGRAMA DE DOCTORADO EN CIENCIAS ODONTOLÓGICAS



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DECLARACIÓN DE CONFLICTO DE INTERESES

D. Mahmoud Almughany declara no tener ningún conflicto de intereses en relación a la Tesis Doctoral titulada:

Comparing the changes of periodontal parameters when using banded and bonded teeth during fixed orthodontic treatment

Comparación de los parámetros periodontales dentales, al usar bandas y elementos adheridos durante el tratamiento de ortodoncia fija

En Santiago de Compostela, 1 de abril de 2025.

Fdo. Mahmoud Almughany



DEDICATION

I dedicate and thanks God, whose blessings, guidance, and strength have carried me through every challenge.

This thesis is dedicated to my beloved family, whose unwavering love, support, and encouragement have been my greatest source of strength. To my parents, Nihad and Inaam, thank you for your sacrifices, guidance, and endless belief in me.

To my wife, Riham, and my children, Nihad, Ahmed, Zeina, and our youngest, Hashem, for their patience and endurance during my studies.

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To My cousins, Rami, Mahmoud, and Saif, for hosting us during the war and providing the essentials of electricity and internet to help me complete my research.

To my dear friends and mentors, thank you for your patience, motivation, and inspiration throughout this journey.

Above all,

This achievement is as much yours as it is mine.

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The completion of a doctoral thesis is the result of years of study and work, in a normal situation but what about my situation?

Can you imagine being a PhD Scholar while living in the midst of a brutal war of extermination?

You must work, progress in your studies, search for academic papers and books to read, organize your thoughts, and write, all while lacking the most basic necessities of life.

There is no electricity, no water, no internet, and no proper food to sustain you through the hardships of war. The roar of military aircraft, bombings, and explosions fill the air as you move from place to place, searching for a safe shelter for yourself and your family.

During the day, you seek ways to charge your laptop and phone, then look for an internet source, relying on e-sim cards that barely provide a stable connection. You wait until everyone is asleep to begin your reading and writing because of the overcrowding caused by displacement and forced eviction from your home.

You search for a café with electricity and internet to meet colleagues who help with your research. You immerse yourself in reading, writing, data analysis, and the repeated attempts to draft a paper for publication, an essential requirement for your PhD.

Asking participants to come for examination and asking God the safety for their life to complete my study.

That's what happened to me during my Ph.D. study as I am living in my hometown Gaza where the war taking place...

After enduring long periods of patience, effort, and hardship, I have finally reached the point of writing this part of my thesis. Despite the unbearable circumstances and the lack of resources, I have overcome this ordeal and reached the end of the journey, proving that strong determination can overcome all obstacles.

In this paper, I extend my gratitude to the Spanish government for its support of the Palestinian people and for being the first country to recognize the State of Palestine.

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DE COMPOSTELA

ABSTRACT

Comparing the changes of periodontal parameters when using banded and bonded teeth during fixed orthodontic treatment

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.

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. The upper right first molar was banded by molar band, while upper left first molar was bonded by molar tube. Participants received instructions for proper oral hygiene and balanced dietary habits. The gingival parameters including Gingival Margin, Plaque Index, Gingival Index, Bleeding on probing and probing depth. These parameters 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, Gingival index, Molar bands.

RESUMEN

Comparación de los parámetros periodontales dentales, al usar bandas y elementos adheridos durante el tratamiento de ortodoncia fija

Objetivo:

Comparar el efecto del uso de bandas molares y tubos adheridos en la salud gingival de los dientes molares superiores durante la aplicación de un aparato ortodóntico fijo.

Material y metodología:

El estudio se llevó a cabo en 60 primer molar superior de 30 participantes, de edades comprendidas entre los 12 y los 35 años, de ambos sexos, que necesitaban tratamiento ortodóntico fijo en la franja de Gaza. El primer molar superior del lado derecho estaba bandado, mientras que el primero molar superior del lado izquierdo estaba adherido. Los participantes recibieron instrucciones sobre la higiene oral adecuada y los hábitos dietéticos equilibrados. Se han evaluado y examinado los parámetros gingivales, incluidos el margen gingival, el índice gingival, la profundidad del sondeo y el índice de placa antes de la colocación de la banda molar y el tubo ligado (T0), a los tres (T3) y seis (T6) meses de tratamiento.

Resultados:

Análisis estadístico independiente de dos muestras t- prueba, indicó que no hay diferencias significativas entre el uso de bandas cementadas y tubos adheridos basado en el tipo de aparato ortodóntico y diferentes variables.

Conclusión:

El estudio demuestra que el uso de bandas molares y tubos tienen un efecto significativo en los parámetros periodontales, al comparar su rendimiento no hay diferencias significativas.

Palabras clave:

Ortodoncia fija, índice gingival, bandas molares, tubo adherido.

RESUMO AMPLIADO

Comparación dos parámetros periodontais dentais, ao usar bandas e elementos adheridos durante o tratamento de ortodoncia fixa

Introdución:

Nos últimos anos, houbo unha crecente demanda de tratamentos de ortodoncia, especialmente nos países desenvolvidos. As bandas molares e os tubos adheridos son considerados, dende fai moito tempo, un compoñente clave no tratamento de ortodoncia fixo.

A Franxa de Gaza, Palestina, é unha zona densamente poboada que contén aproximadamente 2,17 millóns de persoas, que viven en 365 quilómetros cadrados. Ao igual que na maior parte do mundo árabe, existe unha notable escaseza de investigación sobre o tratamento de ortodoncia na Franxa de Gaza. Ademais, hai unha falta de datos actualizados sobre a prevalencia da periodontite na poboación árabe adulta. Non obstante, o tratamento de ortodoncia practícase en moitas clínicas dentais en Gaza e a xente é consciente da súa importancia. Seguen os seus parámetros e progresos a través das redes sociais e derivan os pacientes aos médicos da consulta que solicitan o servizo con fins terapéuticos ou estéticos.

Os aparellos de ortodoncia fixos volvéronse cada vez máis populares para tratar diversas maloclusións e discrepancias craniofaciais en todo o mundo. Isto supón desafíos relacionados coa hixiene bucal debido aos diversos compoñentes implicados, como brackets, bandas, abrazadeiras, arames e outros accesorios. Estes compoñentes poden dificultar o mantemento dunha hixiene bucal óptima, o que leva á acumulación de placa e á posterior inflamación xinxival, que pode variar de leve a grave, ás veces mesmo resultando na aparición de falsas bolsas periodontais. Este desafío é particularmente pronunciado na rexión posterior.

A presenza prolongada de aparellos de ortodoncia fixos dentro da cavidade bucal foi un tema de crecente interese na investigación ortodóntica. Os investigadores están ansiosos por descubrir a relación exacta entre o tratamento ortodóntico e a saúde xinxival e saber se ten posibles efectos secundarios sobre a saúde periodontal. Este tema xurdiu como un punto focal na investigación ortodóntica recente. A cuestión de se se deben facer pontes ou adhesións aos molares durante o tratamento ortodóntico converteuse nun dilema para moitos ortodontistas en exercicio.

Existen diversos resultados de investigación sobre a relación entre as bandas molares e os tubos adheridos e o seu efecto na saúde xinxival. Un resultado dos investigadores suxeriu que as bandas molares están asociadas a unha maior inflamación periodontal en comparación cos tubos molares nos primeiros tres meses. Outros resultados suxiren que o aumento da profundidade da bolsa demostrou que a deposición de placa leva á destrución periodontal arredor das bandas molares. A motivación dos pacientes para manter a hixiene bucal e o raspado regular minimizará este efecto perigoso. En canto ao uso de bandas e tubos molares, os resultados demostraron que poden causar a progresión da xinxivite e que non hai cambios significativos nos parámetros de saúde periodontal co uso de bandas cementadas ou tubos adheridos cando se controla a hixiene bucal.

Outro descubrimento, en pacientes sen problemas periodontais preexistentes, suxire que a colocación de aparellos ortodónticos fixos estivo relacionada cunha acumulación elevada de placa bacteriana, e que a aparición da inflamación pode ser o resultado dunha mala hixiene bucal nas rexións molares e da presenza de vínculos e bandas molares que promoven a retención de alimentos. Outro achado para a poboación da Franxa de Gaza é que a educación parental considérase un factor de risco para a xinxivite, xa que os estudantes cuxos pais teñen un baixo nivel educativo teñen máis probabilidades de queixarse de xinxivite que aqueles cuxos pais teñen un alto nivel educativo.

Hai outros efectos que poden agravar a inflamación das enxivas en presenza de bandas e ligamentos. Atack, N. et al. mencionaron catro factores potenciais que contribúen ao aumento da inflamación xinxival asociada ás bandas ortodónticas. En primeiro lugar, descubriuse que as bandas ortodónticas irritan mecanicamente os tecidos xinxivais. En segundo lugar, pode producirse irritación química debido ao cemento utilizado para fixar a banda, que entra en contacto co tecido xinxival. En terceiro lugar, observouse un maior risco de que os alimentos queden atrapados e causen irritación nas áreas xinxivais e periodontais posteriores. Finalmente, os pacientes tenden a manter hábitos de limpeza máis eficaces para os dentes frontais en comparación cos dentes posteriores.

Esta investigación intenta comparar o efecto do uso das bandas molares e os tubos adheridos na saúde xinxival durante o proceso de ortodoncia fixa. O estudo incluíu unha mostra de sesenta dentes de trinta participantes, de entre 12 e 35 anos, de ambos os sexos, que buscaban tratamento ortodóntico cun aparello de ortodoncia fixo. Mentres se empregaba un aparello de ortodoncia fixo, para cada paciente, o primeiro molar superior do lado dereito foi axustado cunha banda ortodóntica, mentres que o primeiro molar superior no lado esquerdo foi adherido a un tubo para comprobar a diferenza no efecto producido sobre a saúde xinxival.

Hipóteses do estudo:



1. «Non existe unha diferenza estatisticamente significativa ($\alpha \leq 0,05$) no nivel dos parámetros de saúde xinxival (marxe xinxival, índice xinxival, placa, sangrado

ao sondaxe e profundidade de sondaxe) nas bandas cementadas, sendo as variacións atribuíbles ás variables sexo, idade e tempo (T0, T3 e T6 meses)».

2. «Non existe unha diferenza estatísticamente significativa ($\alpha \leq 0,05$) no nivel dos parámetros de saúde xinxival (marxe xinxival, índice xinxival, placa, sangrado ao sondaxe e profundidade de sondaxe) en tubos adheridos, sendo as variacións atribuíbles ás variables sexo, idade e tempo (T0, T3 e T6 meses)».
3. «Non existe unha diferenza estatísticamente significativa ($\alpha \leq 0,05$) no nivel dos parámetros de saúde xinxival (marxe xinxival, índice xinxival, placa, sangrado ao sondaxe e profundidade de sondaxe) entre bandas cementadas e tubos adheridos, sendo as variacións atribuíbles ao tempo (T0, T3 e T6 meses)».

Material e metodoloxía:

Deseño do estudo

O estudo foi deseñado como un ensaio clínico. Isto logrouse fixando o primeiro molar superior dereito cunha banda cementada e o primeiro molar superior esquerdo cun tubo adhesivado. Este método garantiu que ambas unidades estiveran sometidas ás mesmas condicións ambientais, minimizando así posibles variables externas.

Poboación do estudo

Durante o período de recollida de datos, todos os pacientes con idades comprendidas entre 12 e 35 anos que acudiron á clínica privada do investigador solicitando tratamento ortodóncico e cumprían os criterios de inclusión foron informados sobre o estudo. Tras aceptar participar e asinar o formulario de consentimento, sometéronse a unha avaliación de hixiene oral, destartraxe xinxival e recibiron instrucións de hixiene oral antes de seren preparados para a fixación dos aparellos.

Lugar do estudo

O estudo realizouse na clínica privada do investigador (Siwak Dental Clinic), na Franxa de Gaza, Palestina.

Período do estudo

O período do estudo foi desde setembro de 2023 ata novembro de 2024.

Mostra e tamaño da mostra

Foron seleccionados pacientes que acudiron á clínica do investigador desde o 05.03.2024 ata o 04.05.2024 solicitando tratamento ortodóncico con aparellos fixos. A mostra consistiu en 60 dentes pertencentes a 30 participantes.

Materiais:

Esta investigación propuxo utilizar os seguintes materiais relacionados cos aparellos ortodóncicos fixos:

1. Aparello ortodóncico fixo:

- a) Aparello ortodóncico americano, serie Master/Mini, tamaño de ranura 0.22
- b) Tubos ortodóncicos americanos
- c) Bandas metálicas estilo 3M
- d) Arcos ortodóncicos americanos
- e) Ligaduras

2. Gravado ácido: FineEtch (ácido fosfórico ao 37%)

3. Adhesivos:

- a) Adhesivo GC Ortho Connect™
- b) Cimento ionómero de vidro Riva self-cure (SDI)

4. Sonda periodontal

5. Ficha diagnóstica periodontal internacional

6. Folla de Excel para gardar as lecturas

Análise estatística:

As seguintes probas estatísticas foron utilizadas para analizar os datos mediante IBM SPSS Statistics 21:

Proba Chi-cadrado:

Proba t de dúas mostras:

Proba de medidas repetidas:

Proba t pareada:

ANOVA de medidas repetidas:

Metodoloxía:

Foron seleccionados pacientes que acudiron á nosa clínica desde o 05.03.2024 ata o 04.05.2024, consistindo en 60 dentes de primeiros molares pertencentes a 30 participantes con idades entre 12 e 35 anos que acababan de iniciar tratamento ortodóncico con aparellos fixos. Este estudo realizouse en total conformidade cos principios éticos establecidos na Declaración de Helsinki.

Obtívose aprobación ética do Consello Palestino de Investigación en Saúde e o Comité de Ética aprobou o protocolo PHRC/HC/1169/24. Todos os participantes, ou os pais dos pacientes máis novos, recibiron información detallada sobre o estudo e obtívose o seu consentimento informado por escrito antes da súa inclusión. Os participantes foron seleccionados segundo os criterios de elixibilidade.

Criterios de elixibilidade para a selección dos participantes

Algúns criterios empregáronse para seleccionar os participantes; certos requisitos debían cumprirse para ser incluído na investigación, mentres que outros implicaban a exclusión.

a) Criterios de inclusión:

- Pacientes sen periodontite activa.
- Pacientes sen tratamento ortodóncico previo.
- Pacientes sen tratamento periodontal realizado, polo menos, nos últimos 6 meses.
- Pacientes sen hábito tabáquico.
- Pacientes libres de enfermidades sistémicas.
- No caso das pacientes mulleres, ausencia de embarazo.
- Pacientes con idades entre 12 e 35 anos.

b) Criterios de exclusión:

- Pacientes con ausencia dos primeiros molares maxilares.
- Pacientes que requiran expansión do arco ou distalización dos molares mediante aparellos auxiliares.
- Pacientes con enfermidades sistémicas ou que tivesen tomado antibióticos nos últimos 3 meses.

Ao inicio, antes de colocar as bandas ou os tubos nos primeiros molares superiores, realizouse unha avaliación dos parámetros xinxivais, tales como: marxe xinxival, índice xinxival, índice de placa, sangrado á sondaxe e profundidade de sondaxe. Isto considerouse a primeira fase da investigación e denotouse como (T0).

Avaliación clínica:

Os parámetros gingivais foron avaliados mediante exames clínicos. Un exami-nador calibrado levou a cabo as avaliacións utilizando unha sonda da Universi-dade de Michigan O coas marcas de William. Para a medición utilizáronse índi-ces internacionais e utilizouse unha táboa diagnóstica periodontal estandariza-da para documentar os datos.

Criterios de Puntuación:

Usáronse os seguintes índices para medir os parámetros gingivais:

- A clasificación de Miller para a recesión gingival e a de Millers e Damm para a ampliación gingival utilizouse para medir o margen gingival; en caso de recesión gingival usábase (-) antes do número e no caso de ampliación gingival (+) antes do número.
- O esquema Loe & Silness (1963) utilizouse para medir o índice gin-gival e o esquema Silness & Loe (1964) empregouse para a medición do índice de placa.

A profundidade da sondaxe mediuse utilizando a sonda O da Universidade de Michigan coas marcas de Williams, rexistrando a distancia desde o margen gingival ata a parte máis profunda do surco. Tomáronse seis lecturas por dente en lugares específicos.

Resultados:

As bandas cementadas teñen un efecto con diferenzas estatisticamente significativas na maioría dos parámetros gingivais avaliados ($p < 0.05$).

Os tubos adheridos teñen un efecto con diferenzas estatisticamente significativas na maioría dos parámetros gingivais avaliados ($p < 0.05$).

Ao comparar o efecto do uso de bandas cementadas e tubos adheridos sobre os parámetros gingivais, non hai unha diferenza significativa entre os seus efectos sobre ditos parámetros ($p > 0.05$).

Discusión:

O estudo investigou o efecto do uso de bandas molares e tubos adheridos sobre os parámetros de saúde gingival, e comparou entre eles durante o tratamento ortodóntico fixo, tendo en conta o efecto dos factores socioeconómicos e a duración do tratamento. Estes parámetros periodontais son a marxe gingival, o índice gingival, o índice de placa, o sangrado á sondaxe e a profundidade de sondaxe.

O estudo analiza se existen diferenzas significativas ao utilizar bandas ou tubos adheridos nos parámetros de saúde gingival, especialmente coa duración do tratamento,

mentres que os factores socioeconómicos como o xénero e a idade non presentan diferenzas significativas.

Ademais, non existen diferenzas significativas entre o efecto das bandas cementadas e os tubos adheridos nos parámetros gingivais ao comparalos entre si en relación coa variable da duración; ambos presentan cambios non significativos entre eles.

Isto non coincide cun estudo publicado en agosto de 2012 para avaliar a condición periodontal durante o tratamento ortodóntico fixo. Os seus resultados mostraron que os adolescentes presentan un índice de placa máis alto e que a acumulación de placa é máis severa con bandas; porén, nesta investigación, o factor idade non está relacionado cos cambios observados. Isto pode deberse ás instrucións e ao seguimento das visitas relacionadas co mantemento da hixiene oral, o cepillado dental, os hábitos dietéticos e a cooperación dos pacientes.

Outra investigación indicou que o uso exclusivo de bandas cementadas ou de tubos adheridos produce cambios significativos nos parámetros de saúde gingival durante os primeiros seis meses de tratamento con aparellos ortodónticos fixos segundo os criterios do estudo.

Isto coincide cun estudo realizado en 2023 por Mashal Amir et al., sobre o efecto das bandas ortodónticas na saúde gingival dos primeiros molares. Os achados mostraron que as bandas ortodónticas poden afectar negativamente a saúde gingival en pacientes con tratamento fixo, e que a falta de mantemento da hixiene oral agrava aínda máis a mala saúde gingival.

Tamén coincide cun estudo realizado en outubro de 2016, unha análise de supervivencia feita por Oeiras et al., comparando a banda e a adhesión de tubos molares en pacientes adultos durante un período de 12 meses nun ensaio clínico aleatorizado de boca dividida. Concluíron que a adhesión de tubos ortodónticos aos molares é comparable ao bandado molar. Isto coincide cos resultados desta investigación: tanto as bandas como os tubos teñen un efecto adverso sobre a saúde gingival e non presentan diferenzas entre os seus efectos.

Ao comparar o efecto das bandas molares e os tubos adheridos, os resultados mostran que non existen diferenzas estatisticamente significativas entre ambos. Isto coincide cun estudo realizado en xuño de 2016 por Shrestha sobre o estado de saúde oral en pacientes nepaleses con aparellos ortodónticos fixos utilizando bandas e tubos. O estudo concluíu que o uso de bandas e tubos pode provocar progresión da xenxivite, sen cambios significativos nos parámetros periodontais cando a hixiene oral está controlada.

En 2018 realizouse unha revisión sistemática e metaanálise por Papageorgiou et al. para avaliar o efecto do tratamento ortodóntico nos niveis de inserción clínica periodontal. Os resultados mostraron que, segundo estudos clínicos lonxitudinais, o tratamento

ortodóntico fixo ten pouco ou ningún efecto clinicamente relevante nestes niveis, coincidindo cos resultados desta investigación.

Outro estudo realizado en novembro de 2015, por Al-Anezi, avaliou o efecto das bandas ou tubos ortodónticos no estado periodontal durante a fase inicial do tratamento. Os resultados mostraron que as bandas molares se asociaban cunha maior inflamación periodontal en comparación cos tubos nos tres primeiros meses de tratamento. Estes resultados non coinciden cos desta investigación, que indican non haber diferenzas entre bandas e tubos aos 3 ou 6 meses no estado gingival. Esta discrepancia pode deberse ao tamaño da mostra e á idade. No estudo de Al-Anezi, os participantes eran 24 cunha idade media de 12,6 anos (maioría adolescentes), mentres que nesta investigación a mostra era de 30 pacientes, maioritariamente adultos maiores de 18 anos, presumiblemente máis cooperativos e cumpridores das instrucións de hixiene oral.

En 2017, Sameena publicou un artigo titulado “bandas vs adhesións: teñen as adhesións algún papel na colonización microbiana?”. Un dos achados foi que a adhesión molar pode ser unha mellor opción que o bandado para reducir o risco de caries e enfermidades gingivais arredor do aparello ortodóntico.

Estes achados non coinciden cos resultados desta investigación, que non amosan cambios significativos na saúde gingival entre bandas e tubos adheridos. Aínda así, é certo que a adhesión reduce o risco de caries, xa que o tubo cobre unha superficie menor e non rodea totalmente o dente como a banda.

A decisión entre bandado ou adhesión no tratamento ortodóntico fixo é un dilema antigo e recente.

En 1992, hai xa trinta e dous anos, Robert L. Boyd et al. trataron este tema nun estudo titulado Periodontal considerations in the use of bonds or bands on molars in adolescents and adults. O resumo dos seus achados indicaba maior acumulación de placa, inflamación gingival e perda interproximal de inserción nas bandas molares superiores en comparación cos molares adheridos, e valores máis altos de placa e inflamación en adolescentes que en adultos durante e despois do tratamento.

Isto non coincide cos resultados desta investigación, que non atopou diferenzas entre bandas e tubos. A discrepancia pode deberse á duración do estudo: este investigación tivo tres rexistros (antes do tratamento, aos tres e seis meses), mentres que o estudo de Boyd durou arredor de 18 meses. Un período máis longo pode alterar os achados. Ademais, Boyd indicou que os adolescentes presentaban máis acumulación de placa e inflamación gingival, mentres que nesta investigación non se atoparon diferenzas significativas entre idades, posiblemente porque hoxe en día a educación en hixiene oral é máis común tanto en novos como en adultos, e os pacientes prestan máis atención á saúde oral.

En marzo de 2020, un estudo de Talab Alqarari avaliou os cambios na saúde periodontal e a medición de interleucina-1 e interleucina-6 no fluído crevicular gingival despois de colocar bandas ou tubos durante o tratamento ortodóntico.

Os resultados mostraron que as bandas poden ser máis prexudiciais para a saúde periodontal ca os tubos bucais, o que non coincide cos resultados desta investigación. Esta discrepancia pode deberse a que se fixo en grupos control e experimental con 84 molares, e as interleucinas medíronse antes, aos 6 e aos 12 meses.

Un estudo realizado en setembro de 2020 por Lishoy Rodrigus titulado Molar banding or bonding? What do orthodontists prefer in routine clinical practice? atopou que os ortodoncistas prefiren usar tubos adheridos fronte ao bandado. Isto coincide cos resultados desta investigación.

Observando as táboas de resultados, obsérvanse pequenas diferenzas entre bandas e adhesións en parámetros gingivais, pero non son significativas. Por este motivo, recoméndase o uso de adhesións molares polos seus beneficios: aforran tempo clínico, son máis cómodas para o paciente, non requiren separadores, todo o procedemento faise nunha visita, e a detección de caries é máis doada.

En 2003, Afrah Al Hamdany publicou un artigo sobre os cambios na enxiva en dentes con bandas e adhesión ortodónticas.

Os resultados indicaron que as bandas inducían máis cambios periodontais ca os brackets. Isto non coincide cos resultados desta investigación, que non atopou diferenzas significativas entre bandas e tubos. Esta discrepancia pode deberse a que o estudo de Afrah incluíu diferentes áreas dentarias: bandas colocadas en primeiros molares superiores e inferiores, mentres que o resto dos dentes estaban adheridos. Os dentes avaliados incluían incisivos centrais primeiros molares en diferentes cadrantes.

As diferenzas entre áreas dentarias (anterior máis limpa, posterior e menos accesible) poden alterar os resultados. Nesta investigación, tanto bandas como tubos estaban situados na zona posterior, baixo as mesmas condicións ambientais.

Conclusión:

A saúde oral é unha preocupación importante nos pacientes con aparellos ortodónticos fixos. O uso de bandas cementadas e tubos adheridos nos molares durante o tratamento ortodóntico fixo non presenta diferenzas significativas nos efectos producidos nos parámetros de saúde gingival, xa que ambos poden influír nestes parámetros a corto prazo.

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1

Introduction

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1 INTRODUCTION

In recent years, there has been a growing demand for orthodontic treatments especially in developed countries.(1) Molar 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)

After the introduction of acid etching of enamel by Buonocore in 1955, direct bonding of orthodontic brackets to incisors, canines, and premolars is now carried out routinely as part of fixed appliance treatment. However, bands remain the most common means of attaching components to molars compared to bonding of buccal tubes. The decision to band or bond a molar may be influenced by several factors including a history of congenital cardiac defect, rheumatic fever or prosthetic cardiac valve placement.(6)

the height of the clinical crown, or the need to use headgear. Orthodontic bands need to be adapted; especially in partially erupted teeth as they have to be placed sub-gingivally. Direct mechanical and chemical irritation of gingival tissues, due to the cement used for banding cementation and greater plaque retention was established as the main causes of the inflammatory phenomenon in this region. Bonding rather than banding molars, however,

reduces chairside time and leads to less plaque accumulation and gingival inflammation thereby reducing the risk of enamel demineralization.(7)

The effects seen clinically following the insertion of orthodontic appliances into the oral cavity can contribute to chronic infection, inflammatory hyperplasia, irreversible loss of attachment (permanent bone loss), and gingival recession. (8)

The onset of periodontic diseases in orthodontic patients can be traced to:

More difficult maintenance of oral hygiene. Plaque retention to orthodontic devices Bone/ periodontal movement and remodelling under orthodontic forces, which can favor the accumulation of subgingival plaque and enhance the periodontal pathogens potential. (9)

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.(10)

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 bonds in the first three months.(11) 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. (12)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.(13) 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 bonds and bands which favors food lodgment.(14) 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.(15)

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.(16)

According to Bmsc et al.,2018 The success of every orthodontic therapy still relies on four old-fashioned key components: the diagnostic and clinical skills of the orthodontist, favorable biologic characteristics of the patient (bone turnover, craniofacial morphology, stage of growth, etc.), patients' willingness to cooperate during treatment and to follow all treatment recommendations (i.e., patient compliance), and the use of an appropriate and effective orthodontic appliance.

This research endeavours 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.

1.1 AIMS

- a. Comparing between using molar bands and bonded tubes on upper first molar teeth.
- b. Estimating their effect on the gingival health while using fixed orthodontic appliance for patients seeking orthodontic treatment in Gaza strip, Palestine.

1.2 STUDY DESIGN

The study was designed as a clinical trial. This was achieved by fixing the right-side first molar to a cemented band and the left-side first molar to a bonded tube. This method has ensured that both units are subject to the same environmental conditions, minimizing potential external variables.

1.3 LITERATURE REVIEW

1.3.1 Related Articles

- In February 2023, a study done by Mashal et.al. to test the effect of orthodontic banding on gingival health of first permanent molars. The aim of this study is to determine the effect of orthodontic banding on gingival health of first permanent molars. Study was conducted on 70 patients by non-probability consecutive sampling technique. Both genders, adult (age 18-40 years) needing orthodontic fixed treatment and having all first permanent molars were included. Patients with medications and medical conditions affecting gingival health and history of periodontal disease were excluded. The gingival health was assessed using gingival and plaque indices before and six months after banding of molars. Paired T. test was used for comparing the gingival and plaque indices before and six months of treatment. The findings for this study were Orthodontic banding can adversely affect the gingival health in patients receiving fixed appliance treatment. Lack of proper oral hygiene maintenance further aggravates poor gingival health.(17)
- In September 2020, a study done by Lishoy et al. titled as Molar Banding or Bonding? What do Orthodontists Prefer in Routine Clinical Practice? Done as a questionnaire-based survey aims to evaluate whether orthodontists prefer molar banding or bonding in their routine clinical practice. Using a sample of 157 participants (orthodontists) was taken after assessing the sample size within the age group of 27 - 50 years of age. The participants comprised orthodontists practicing in various parts of India. A Questionnaire was created on Google forms and circulated to participants using various social media platforms. Most Orthodontists preferred bondable molar tubes over banding in routine orthodontic practice. The most common problem faced by most orthodontists associated with banding was increased chair-side time and increased gingival impingement and irritation, whereas the most common problem faced by them associated with bonding with bondable molar tubes was increased tendency of breakages. Most Orthodontists felt that banding in orthodontics was unnecessary as it took up a lot of clinical time and they also asserted that in their experience, frequency of breakages was mostly associated with bondable tubes than bands. However, the most striking and highlighting feature of this study was that participants believed that banding molars did not have any added advantage over using bondable molar tubes. The findings were Orthodontists preferred using bondable molar tubes over molar banding in their routine clinical practice as they believed that it saved a lot of clinical time, provided benefits that outweighed its drawbacks and moreover were in no way inferior to molar banding when used during routine fixed orthodontic treatment.(10)

- In 2017, a study done by Sameena et al. to compare Molar bands Vs bonds: Does bonding cements have role in microbial colonization. The aim of this study was to investigate changes in subgingival cariogenic microbiota before and one month after the placement of orthodontic bands and bondable molar tubes using four different bonding materials. Using thirty patients undergoing orthodontic treatment of age group between 12 to 25 years, were randomly selected from post graduate clinic. All first molars were banded or bonded randomly quadrant wise, using four different materials (fluoride releasing and non-fluoride releasing adhesives, chemically cured and light cured GIC). Subgingival microbial samples were taken from mesio-proximal site of the selected teeth before and one month after the placement of bands and bondable molar tubes. The samples were then inoculated on selective culture media to evaluate for Streptococcus mutans and Lactobacilli. Colonies of Streptococcus mutans and Lactobacilli were counted under digital colony counter. They find that Bacterial colonization around molar bands was significantly higher compared to molar bonding, irrespective of the material being used for banding and bonding. Hence, molar bonding may be a better option as against molar banding to reduce the risk of caries and gingival diseases around the orthodontic appliances. Use of fluoride releasing and non-fluoride releasing adhesives, chemically cured and light cured GIC does not make any difference in the bacterial colonization.(18)
- In 2017, a study done by Spyridon et al. to find effect of orthodontic treatment on periodontal clinical attachment: a systematic review and meta-analysis study. The aim of this systematic review was to assess the effect of comprehensive treatment with fixed orthodontic appliances on clinical attachment levels of adolescent and adult periodontally healthy patients. Seven databases were searched from inception to February 2017. Selection criteria was Prospective non-randomized longitudinal clinical studies. The conclusion was according to existing evidence from longitudinal clinical studies orthodontic treatment with fixed appliances has little to no clinically relevant effect on periodontal clinical attachment levels.(19)
- In June 2016, a study done by Sandhya et al. to study the Oral Health Status in Patients with Fixed Orthodontic Appliances with Molar Bands and Bonded tubes of Nepalese orthodontic patients. A total of 112 orthodontic patients aged between 13-30 years were assessed for Plaque Index, Gingival Index, Calculus Index, and pocket depth on upper first molars with cemented bands and bondable tubes. Statistical analysis was done using the Chi-square test to find the association between cemented molar bands and bonded molar tubes to periodontal status. The results were very few orthodontic patients showed poor plaque accumulation sore, severe gingivitis, and calculus deposits. The Gingival Index showed a significant association between the cemented molar band and

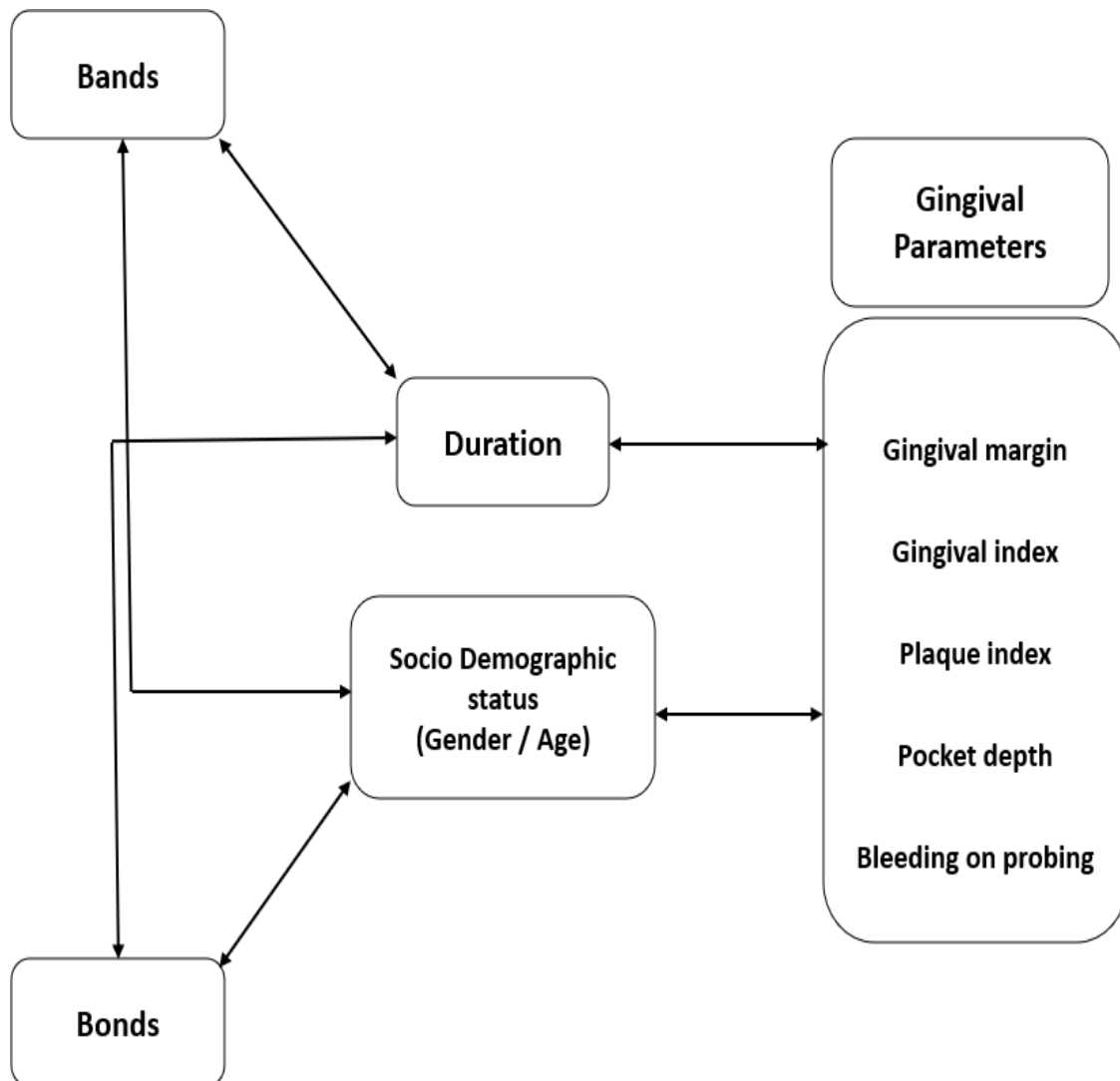
bonded molar tube. The conclusion was oral health is an important concern in fixed orthodontic patients. Use of both molar band and molar tube can cause the progression of gingivitis. There is no significant change in periodontal health parameters in using cemented bands or bonded tubes when oral hygiene is controlled.(13)

- In November 2016, a study done by Hadeel et al. To test effect of fixed orthodontic appliances on gingival health. The aim of the study was to compare periodontal health of patients with and without orthodontic treatment with fixed orthodontic appliance using a sample composed of 70 subjects with age ranged between 18 - 30 years old. The subjects were divided into two groups: Group I was composed of 30 subjects (15 females and 15 males) who were not wearing orthodontic appliances. Group II was composed of 40 patients (20 females and 20 males) who were wearing fixed orthodontic appliances at least for three months before conducting the study. Plaque index, gingival index and bleeding on probing were measured for all groups. The findings suggest that orthodontic appliance increase the plaque accumulation and may lead to gingival inflammation. Patients wearing fixed orthodontic appliances should maintain a good oral hygiene.(20)
- In August 2016, a study done by Martha et al. to estimate the clinical evaluation of the periodontal condition during fixed orthodontic treatment. The aim of the clinical study was to examine the periodontal status of patients before, during and after orthodontic appliances are used. 50 patients were selected, plaque index, gingival index, modified papillae bleeding index and clinical probing depth was evaluated on anchorage teeth, separately those with orthodontic bands and tubes. One of the most common findings during this kind of treatment is gingival alteration in the posterior region. Practical observations showed a different status of these alterations at patients wearing bands on the anchorage teeth versus those with buccal tubes. Using some of the indices which describes the periodontal status at adult and adolescent patients, found that adolescents present a higher plaque index, and the accumulation of dental plaque is more severe when bands are used in both categories. Another finding, which is very important in everyday practice is that gingival inflammation and plaque accumulation decrease one month after debonding.(21)
- In October 2016, a study done by Valéria et al. as a Survival analysis of banding and bonding molar tubes in adult patients over a 12-month period: a split-mouth randomized clinical trial. This split-mouth randomized clinical trial aimed to compare the survival rate of bonding and banding molar tubes in adult orthodontic patients. A total of 59 banded and 59 bonded molars were followed up for 12 months. The findings were no serious problem was observed other than gingivitis associated with plaque accumulation. (22)

- In November 2015, a study done by Al-anezi et al. to test the effect of orthodontic bands or tubes upon periodontal status during the initial phase of orthodontic treatment. Orthodontic bands cause periodontal inflammation. As in theory, the use of a buccal tube instead of a band should prevent or minimize periodontal changes because the bands are positioned away from the gingival margins. The primary aim of this study was to investigate the periodontal status of orthodontic bands compared with bands in the first three months of orthodontic treatment. Using Twenty-four orthodontic patients mean age =12.6 years were enrolled in this Randomized Controlled Trial (RCT). Using the cross-mouth technique, bands and tubes were used in opposite quadrants. Periodontal parameters including the presence or absence of Bleeding on Probing (BOP) and Probing Depths (PDs) were taken at the start and three months into treatment. The conclusion was Molar bands are associated with greater periodontal inflammation compared with molar tubes in the first three months of fixed orthodontic treatment.(11)
- In 2011, a study done by Imtiaz et al. To test the periodontal status of first molars during orthodontic treatment. The aim of the study was to investigate the negative changes in periodontal health (increase in pocket depth) of first molars in fixed orthodontic treatment and to discuss the available options to avoid it. Methods: Group A (6 month of treatment) comprised of 45 patients, compared to Group B (12 month of treatment) comprised of 45 patients. Initial pocket depth of first molars checked before placement of molar bands in both groups of patients, then for Group A patients pocket depth evaluated after 6 month of treatment and for Group B patients pocket depth evaluated after 12 month of treatment period. In patients with 6 months of treatment the pocket depth of molars mostly falls between 1.5 and 2.0 mm. In some severe cases it exceeded 3 mm. In patients at 12 months of treatment pocket depth was greater than 6 month group and it mostly fell in the range of 2.0–2.5 mm. The findings was Increase in pocket depth showed that plaque deposition leads to periodontal destruction around molar bands. Patient motivation to maintain oral hygiene and regular scaling will minimize hazardous effects.(12)
- In 2003, a study done by Afrah et al. To test the Changes in gingiva with orthodontically banded and bonded teeth. The aim of this study was to evaluate the effect of orthodontic bands and metal brackets on the gingival health. The sample was composed of 15 randomly selected patients (5 males and 10 females) 11 to 17 years old. All patients were treated with edgewise fixed orthodontic appliances. Bands were cemented to upper and lower first molars and rest of teeth were bonded with composite. The teeth included in the study were upper right and lower left central incisors, and upper left and lower right first molars. The plaque index, the gingival index and pocket depths were used

to measure the oral hygiene of the patients during six months period of fixed orthodontic treatment. The results indicated that orthodontic bands provoked more periodontal changes than brackets.(23)

1.3.2 Conceptual framework:



1.3.3 Ortho- Perio relationship overview

Orthodontic-periodontic interactions are mutually beneficial. The combined approach can greatly enhance periodontal health and dentofacial aesthetics in many situations. As Orthodontic treatment aims to achieve both functional and aesthetic alignment of teeth through controlled movements, which are closely tied to how teeth interact with their supporting periodontal tissues. (24)

Orthodontic treatment can be justified as a part of periodontal therapy if it is used to reduce plaque accumulation, correct abnormal osseous shape, enhance appearance and esthetic, and aid in prosthetic restoration. Recently, with the increased number of adults seeking orthodontic treatment, orthodontists frequently face a lot of periodontal problems with patients during the treatment period. The combined orthodontic-periodontic interdisciplinary approach could be effective in these situations. Thus, oral hygiene measures are recommended because bands, brackets, ligatures wires, and elastics encourage the accumulation of microbial flora and food residues.

Malocclusion, a prevalent oral-maxillofacial abnormality, adversely affect facial aesthetics, oral function, and gingival health. Orthodontic treatment stands as the preferred and most commonly utilized method to solve these abnormalities. However, debate has surrounded its potential harm to periodontal tissues. (25)

This speculation arises from the orthodontic appliance potential to increase plaque accumulation and gingival inflammation resulting from changes in the oral environment following the use of braces. (26) This, in turn, can alter the composition of oral microflora and in the physiology of the host.(27)

Interestingly, orthodontic tooth movement can often lead to improved periodontal health, while periodontal therapy can facilitate orthodontic treatment. Thus, orthodontic treatment is a double-action procedure, regarding the periodontal tissues.(28)

1.3.3.1 Benefits of orthodontic treatment for a periodontal patient

Orthodontic therapy offers numerous advantages to adult patients dealing with periodontal issues. Here are six key benefits to consider:

1. **Improved Access for Cleaning:** Aligning crowded or malposed anterior teeth in the upper or lower jaw allows better access for patients to thoroughly clean all teeth surfaces. This is particularly beneficial for individuals prone to alveolar bone loss or those with limited dexterity in maintaining oral hygiene.
2. **Enhancement of Osseous Defects:** Vertical repositioning of teeth through orthodontic treatment can help improve certain types of osseous defects in periodontal patients. This often eliminates the need for invasive osseous surgery.
3. **Enhanced Aesthetics:** Orthodontic treatment can optimize the esthetic alignment of the maxillary gingival margin levels, particularly before restorative dentistry procedures. By aligning gingival margins orthodontically, the need for gingival recontouring and potential bone removal is minimized, reducing the risk of root exposure.

4. Facilitation of Restorative Procedures: Severe fractures of maxillary anterior teeth may necessitate forced eruption to enable adequate root restoration. By extruding the tooth, orthodontic treatment provides the necessary resistance form and retention for the final restoration during crown preparation.
5. Correction of Gingival Embrasures: Orthodontic treatment can correct open gingival embrasures to restore lost papilla, particularly in the maxillary anterior region where aesthetics are critical. Through a combination of orthodontic root movement, tooth reshaping, and/or restorative procedures, these areas can often be effectively corrected.
6. Optimization for Implant Placement: Orthodontic treatment can improve the positioning of adjacent teeth before implant placement or tooth replacement, especially in cases where teeth have been missing for an extended period, resulting in drift of adjacent teeth into the edentulous space. (29)

1.3.3.2 Adverse effect of orthodontic procedures on periodontal tissues

Orthodontic procedures can have adverse effects on periodontal tissues, including gingival inflammation, hyperplasia, and the proliferation of periodontal pathogens. Previous studies have highlighted various issues such as gingivitis, periodontitis, gingival recession, and the formation of gingival pockets during or after orthodontic treatment. (30)

Gingival inflammation and hyperplasia may occur quickly after the placement of a fixed appliance such as orthodontic bands and the development of these problems appears to occur more frequently in interproximal sites and more commonly in posterior teeth compared with anterior teeth. (20) Different studies shows molar bands are associated with more gingival and periodontal problems.(31). Gingival enlargement during orthodontic treatment has different effects: impeding oral hygiene, interfering with occlusion, mastication, phonetics, which can also cause aesthetic and psychological problems, in turn, compromising the orthodontic tooth movement.(32)

1.3.3.3 Periodontal tissue response and orthodontic forces

The response of periodontal tissues to orthodontic forces plays a crucial role in tooth movement. Controlled forces applied during orthodontic treatment induce remodeling changes in dental and periodontal tissues. These forces compress the alveolar bone and the periodontal ligament on one side while stretching the ligament on the opposite side. This leads to bone resorption on the compressed side and bone deposition on the tension side. (33)

Different levels of orthodontic force have distinct effects: light orthodontic forces cause periodontal ligament ischemia with simultaneous bone resorption and deposition, resulting in continuous tooth movement. Moderate orthodontic forces lead to periodontal

ligament strangulation and delayed bone resorption, while heavy orthodontic forces cause ischemia and degeneration of the periodontal ligament, resulting in hyalinization and further delay in tooth movement. (34)

Orthodontic movement is possible because of the bone remodeling of alveolar bone. The forces exerted by the wires on the teeth are transduced to the PDL, provoking cellular and extracellular tissue response. Bone remodeling is regulated by a balanced system of two types of cells osteoblasts and osteoclasts and includes a complex network of interactions between cells and extracellular matrix in the presence of hormones, cytokines, growth factors, and mechanical loading.(35)

When the bone's surface is remodeled in the direction opposite to the way it is being shifted by the growth of nearby structures, the situation becomes similar to a cartoon scenario: the wall is being reconstructed to move backward at the same time the platform it sits on is also moving.(36)

1.3.3.4 Orthodontic treatment as an adjunct to periodontal therapy

Orthodontic treatment can play a valuable role as an adjunct to periodontal therapy in many cases. Procedures such as uprighting, intrusion, and rotation are utilized to correct pathologically migrated teeth, that control further periodontal breakdown, enhancing oral function, and improving aesthetics. It's crucial that these orthodontic procedures are undertaken only after controlling the periodontal disease.

Although there is no consistent relation between malocclusion and periodontal disease, certain characteristics of malocclusion can promote a pathologic environment and hinder periodontal therapy. (37)

Correcting crowded or malposed teeth improves access for thorough cleaning of tooth surfaces and reduces food impactions by establishing proper arch form and proximal contact. (38)

Orthodontic Uprighting of tilted molars offers several advantages: distal tooth movement allows alveolar bone deposition in mesial defects, eliminating gingival folding and plaque-retentive areas on the mesial side. (39)

Orthodontic extrusion may be indicates for shallowing intraosseous defects and for increasing clinical crown length for single teeth. Extrusion results in coronal positioning of intact connective tissue attachment along the tooth and also the bone deposition.(40)

Orthodontic intrusion is recommended for teeth with horizontal bone defects or infrabony pockets, The intrusion of plaque-infected teeth may lead to apical displacement of supragingival plaque, which results in periodontal destruction. However, meticulous

supragingival and subgingival scaling are crucial during intrusion treatment to prevent periodontal destruction. (41)

Furcation defects pose challenges during orthodontic treatment and require special consideration. In Class III furcation cases, hemisecting the crown and root and pushing the roots apart may be beneficial. (37)

Hemiseptal defects can be addressed through uprighting, extrusion, and leveling of the bone defect, with the tooth's bodily movement improving adjacent tooth positioning, potentially facilitating implant or tooth replacement.(42)

In cases where teeth are supraerupted with osseous defects, intrusion and leveling of the bone defect can help resolve these issues effectively. Careful coordination between orthodontic and periodontal therapies ensures optimal outcomes and long-term periodontal health.

1.3.3.5 Orthodontic procedures for the enhancement of periodontal condition

The orthodontic treatment is aimed to correct the irregularities and malrelationship of dental and surrounding hard tissues.(17)

malocclusions like crowding, tipping, buccoversion and labioversion can produce periodontal diseases, as they make oral hygiene maintenance very difficult, so the need for periodontal care and visiting periodontal clinics to control oral hygiene is mandatory. Orthodontic treatment solves this problem as teeth are placed well aligned over the bone and oral hygiene as brushing or flossing becomes easily maintained in addition will aligned teeth will prevent trauma to oral structures. (43)

Fixed orthodontic treatment with multibracket appliances significantly increases plaque accumulation leading to significant inflammatory changes in the gingival tissues without any significant changes in the clinical probing depths of the pockets regardless of age and gender.(43)

So Gender, age, oral hygiene, and treatment duration were the most important risk factors for GE during fixed orthodontic treatment.(44)

1.3.4 Periodontal Examinations

1.3.4.1 Index

These are numerical values describing the relative status of the population on a graduated scale with definite upper and lower limits, which are designed to permit and facilitate comparisons with other populations and are classified by the same criteria and methods.

1.3.4.2 *Periodontal Probe*

The periodontal pocket, a key indicator of periodontal disease, is routinely assessed by dental clinicians and is among the most commonly evaluated parameters. Periodontal probes are considered one of the most reliable and convenient tools for detecting, measuring, and assessing the status of periodontal disease activity. Through periodontal probing, dentists can identify sites with a history of periodontal disease or those vulnerable to periodontal breakdown. As described by Orban et al., periodontal probes serve as the "eye of the operator beneath the gingival margin" and are an integral component of a comprehensive dental examination.(45)

Periodontal probes, derived from the Latin word "probo," meaning "to test," serve various essential functions in dental practice. Primarily, they are utilized to detect and measure periodontal pockets and clinical attachment loss. Additionally, periodontal probes are employed to:

- Locate calculus deposits.
- Measure gingival recession and the width of attached gingiva.
- Assess the size of intraoral lesions.
- Identify tooth and soft tissue anomalies.
- Locate and measure furcation involvements.
- Determine mucogingival relationships.
- Assess bleeding tendencies.

Overall, periodontal probes play a critical role in the comprehensive evaluation and management of periodontal health and disease.(46)

Despite its utility, periodontal probing is subject to certain limitations. Reading errors may arise due to various factors, including:

- Interference from calculus deposits on the tooth or root surface.
- Presence of an overhanging restoration.
- Contour of the crown.
- Operator-related errors, such as incorrect angulation of the probe, inconsistent pressure applied to the probe, misinterpretation of probe readings, imprecise data recording, and miscalculation of attachment loss.

These limitations underscore the importance of careful technique and interpretation when utilizing periodontal probing in clinical practice.(47)

1.3.4.3 Gingival Margin

PD Miller's classification for gingival recession:(48)

- Class I: Marginal tissue recession that does not extend to the mucogingival junction. There is no loss of bone or soft tissue in the interdental area. This can be narrow or wide.
- Class II: Marginal tissue recession that extends to or beyond the mucogingival junction. There is no loss of bone or soft tissue in the interdental area. This can be narrow or wide.
- Class III: Marginal tissue recession that extends to or beyond the mucogingival junction. In addition, there is loss of bone and/or soft tissue in the interdental area or there is mispositioning of the tooth.
- Class IV: Marginal tissue recession that extends to or beyond the mucogingival junction with severe loss of bone and soft tissue interdentally and/or severe mispositioning of the tooth.

Millers and Damm classification for gingival enlargement (1992):(48)

- Grade 0: Normal gingival , No alterations
- Grade 1: minimal overgrowth ≤ 2 mm, gingival covering the cervical third or less of the anatomical crown.
- Grade 2: moderate overgrowth, 2 to 4 mm gingival covering the middle third of the anatomical crown.

Grade 3: severe overgrowth ≥ 4 mm nodular growth, gingival covering more than thirds-two of the dental crown.

Note: in this research, using the following before the grade or class numbers

- **Number alone means there is gingival enlargement as 1, 2 , 3**
- **Using minus (-) ebofeb the number means gingival recession as -1, -2, -3**

1.3.4.4 Gingival Index by Loe H and Sillness J (1963)

This index was solely developed for the purpose of assessing the severity of gingivitis and its location in four possible areas.

Method:

The severity of gingivitis is scored on all surfaces of all teeth, or selected teeth, or on selected surfaces of all teeth, or, selected teeth. The tissues surrounding each tooth are divided into four gingival scoring units:

- Distal facial papillae,
- Facial margin,
- Mesial facial papillae,
- Entire lingual gingival margin.

A blunt instrument is used for recording the scores based on the following criteria:

0: No inflammation

1: Mild inflammation, no bleeding elicited on probing

2: Moderate inflammation, bleeding on probing

3: Severe inflammation

The scores around each tooth are added and divided by four to arrive at the score for that particular tooth. Total all the teeth scores and divide it by the number of teeth. This provides the gingival index score per person. The numerical values are correlated as follows:

0.1 to 1.0: Mild gingivitis

1.1 to 2.0: Moderate gingivitis

2.1 to 3.0: Severe gingivitis

1.3.4.5 Plaque Index by Sillness and Loe (1964)

It is unique among the indices used for assessment of plaque because it ignores the coronal extent of plaque on the tooth surface area and assesses only the thickness of plaque at the gingival area of the tooth.

Method:

The evaluation or scoring is done on the entire dentition or on selected teeth. The surfaces examined are the four gingival areas of the tooth, i.e. the distofacial, facial, mesiofacial and lingual surfaces. A mouth mirror, light source, a dental explorer and air-drying of the teeth and gingiva are used in the scoring of this index. Only plaque of the cervical third of the tooth is evaluated with no attention to plaque that has extended to the middle or incisal thirds.

Scoring Criteria:

- 0: No plaque in the gingival area
- 1: A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be recognized only by running a probe across the tooth surface.
- 2: Moderate accumulation of soft deposits within the gingival pocket and on the gingival margin and/or adjacent tooth surface that can be seen by naked eye
- 3: Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

The score for the area is obtained by totaling the four scores per tooth and dividing it by four.


Probing depth:

Probing or Pocket depth (PD), measured with The University of Michigan O probe with Williams markings (at 1, 2, 3, 5, 7, 8, 9) 4 and 6 missing. recorded as the distance from the gingival margin to the most apical part of the sulcus. Six readings were carried out per tooth (mesiobuccal, buccal, distobuccal, mesiolingual, lingual, distolingual)

1.3.4.6 Gingival Bleeding Index by Ainamo and Bay

The index was developed as an easy and suitable way for the practitioner to assess a patient's progress in plaque control. 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, which is expressed as a percentage of the total number of gingival margins examined.

Note: in this research the following was used:

- 
- (+) means yes there is bleeding
 - (-) means there is no bleeding.

1.3.4.7 Factors play a crucial role in determining the outcome and prognosis of orthodontic-periodontal treatment

It's essential to evaluate these factors before initiating orthodontic treatment to ensure successful outcomes for patients:

General Health Conditions and Periodontal Susceptibility: Certain systemic conditions, such as psychological stress, smoking, immune deficiencies, diabetes, osteoporosis, autoimmune disorders, and the presence of periodontal pathogens, can influence the progression of periodontal disease. Orthodontic treatment may not affect bone level or long-term periodontal health in patients without periodontal disease and good oral hygiene. However, in patients with active periodontal disease, orthodontic tooth movement can exacerbate the condition, even with good oral hygiene.

Severity of Periodontal Disease: The progression and patterns of periodontal disease vary among individuals. In addition, some individual sites of teeth may be at higher risk given their anatomical conditions. (49)

Orthodontic strategies must consider the severity and individual characteristics of periodontal disease to achieve optimal results.

Malocclusion: Different orthodontic strategies are employed based on the diagnosis of malocclusion. The removal of periodontally compromised teeth and tooth movements to treat malocclusion can lead to major improvements in oral hygiene. Tooth movements to treat malocclusion can improve oral hygiene, particularly in cases of crowding, which increases the risk of gingivitis. Crowding alone has been reported to increase the risk of gingivitis, regardless of bacterial plaque levels. (49)

How Malocclusion can Lead to Periodontal Disease: (50)

Malocclusion is a dental condition where the teeth are misaligned in such a way that the upper and lower jaws do not close properly. This condition can affect regular activities like chewing and eating and trigger oral health problems. Malocclusion is one of the most common health problems, and it can affect people in different degrees that range from mild to extremely severe. One particular adverse affect of this condition is periodontal disease.

- Malocclusion makes it difficult to remove plaque and food particles that are stuck between misaligned teeth. This can lead to redness of the gums and bleeding while brushing your teeth or flossing.
- Over time, the bacteria that breed on the plaque and food particles will enter inside the body through the blood, resulting in bacterial infections and tooth degradation.

- Plaque may also cause bad breath or halitosis, which results in gum inflammations.
- Badly aligned teeth create a lot of pressure on your teeth and jaws. The teeth subjected to unnatural strain can get chipped, and notches in the gum line called 'abfractions' can surface.
- Untreated gum inflammation can lead to damage of soft tissue, receding gums, and lead to pocket formation between the teeth and gums, resulting in bone loss.
- Continuous strain can result in poor root support and loosen your teeth, and you may lose one or more teeth as a result.
- In more serious cases, periodontal disease can increase the risk of atherosclerosis or hardening of the arteries.

As you can see, malocclusion is not a problem about aesthetic appeal. It can be a serious dental health problem as well, leading to periodontal disease, dental caries, headaches and tooth pain. Some people have no symptoms at all, while others suffer from several symptoms

Alveolar Resorption Pattern: Orthodontic movements can be achieved in teeth with intraosseous defects if periodontal disease is inactive. Extrusive movements may help position connective tissue insertion more occlusally and minimize intraosseous defects. Intrusion can improve the periodontal condition of healthy tissues when oral hygiene is good.

Periodontal Biotype: Patients with thin periodontal biotypes may experience bone dehiscence with dental movements towards the vestibule, in the presence of plaque, can lead to gingival recession. (49)

Conversely, patients with thick periodontal biotypes or movements towards the lingual may experience fewer recessions or even regression of dehiscence and fenestration.

Oral Hygiene Levels: Optimal oral hygiene is crucial before and during orthodontic treatment. Periodontal pockets that hinder good hygiene should be addressed before orthodontic intervention. In some cases there is exceptions, in which orthodontic treatment is first indicated, such as when the removal of pockets is difficult because of poor dental position.

By considering these factors and tailoring treatment plans accordingly, orthodontic-periodontal treatment can achieve successful outcomes and maintain long-term periodontal health for patients.

1.3.4.8 Actions that contribute to a successful treatment

Several measures contribute to the success of orthodontic treatment, particularly in reducing factors that promote bacterial plaque buildup. Here are key actions to consider:

Orthodontic Appliance Construction: Orthodontic appliances and adhesive remnants significantly increase plaque buildup, risk factors in periodontitis patients. Construction of fixed devices should minimize plaque retention properties and be as simple as possible. These appliances and adhesive remnants are known to significantly increase plaque buildup, which is an important risk factor in periodontitis patients. They are also responsible for the increase of supra and subgingival microflora and their change to more pathogenic species. (51)

Molar Bands vs. Tubes: Molar bands may lead to increased plaque buildup, pocket depth, and bacterial colonization compared to tubes. Whenever possible, tubes should be used for better control of plaque accumulation in the gingival area.

Ligatures: Metal ligatures reduce plaque buildup and the number of microorganisms compared to elastomeric ligatures, making them preferable for periodontal patients.

Adhesive Material: Excess adhesive material can harbor mature plaque, highlighting the importance of careful adhesive application to avoid plaque retention sites.

Biomechanics Consideration: Biomechanical design of orthodontic devices should accommodate changes in periodontal patients, such as the loss of alveolar bone. Adjustments in forces and moments may be necessary to prevent adverse effects on periodontal tissues.

It is recommended to reduce the forces, and it might be necessary to add a greater moment, produced by a couple applied to the tooth, to overcome tipping time and produce a movement in body, avoiding tooth inclination. (51)

Retention: Retainers should match tooth morphology and be cemented carefully to avoid plaque retention. Regular checks are essential to detect plaque buildup or detachment, and compliance with maintenance schedules is crucial for long-term periodontal health. Compliant patients during periodontal maintenance and orthodontic containment treatment show less recurrence of periodontitis and less tooth loss than non-compliant patients.(52)

1.3.4.9 Periodontal assessment guidelines

Oral hygiene preservation during orthodontic treatment is only possible by proper teaching to the patient, their enthusiasm, collaboration and their approach towards their treatment played an active role to maintain oral hygiene.(53,54) lot of researches proved

that patients either lack knowledge of proper hygiene maintenance or show carelessness in maintaining it. Despite having the knowledge some patients still fail to follow proper oral hygiene instruction.(53)

Before treatment, patients must demonstrate adequate oral hygiene capability and orthodontist must ensure that the patient is able to take the necessary measures for adequate oral hygiene. Orthodontic treatment should be postponed if hygiene requirements are not met. Routine clinical and radiographic evaluations should be conducted, with referrals to periodontal evaluation for patients with pathological periodontal conditions. The patient should be informed that non-adherence to the oral hygiene protocol will result in suspension of orthodontic treatment. (55)

Prior to orthodontic treatment, a clinical and x-ray evaluation should be routinely performed. The clinical evaluation should include a full periodontal examination of mouth, dental mobility, and gingival recession.

Hygiene and Motivation Instruction: Hygiene instruction should be provided during orthodontic treatment, emphasizing the importance of plaque control. Patients should be monitored for adherence to hygiene protocols, with adjustments made as necessary.

Periodontal Evaluations: Periodontal evaluations should occur every three months during active orthodontic treatment and at least once a year thereafter. orthodontic devices generally have a negative effect on oral hygiene; it is therefore necessary to make the required adjustments continuously. Non-adherence to hygiene protocols requires at least a pause in orthodontic treatment until significant improvement is evident. Radiographic assessments aid in detecting cavities and root resorption.

Post-Treatment Monitoring: After orthodontic treatment, regular appointments are essential to detect early signs of periodontal disease. Clinical evaluations supplemented with yearly x-rays help monitor periodontal health and assess the impact of retainers on plaque retention.

By implementing these actions and closely monitoring periodontal health throughout orthodontic treatment, the risk of adverse outcomes can be minimized, and successful treatment outcomes can be achieved.

1.3.4.10 Periodontitis among adult populations in the Arab World

The Arab World comprises 22 countries from North and North-east Africa, and the Middle East.

A recent review of the burden of oral diseases in the Middle East found that little attention has been given to periodontitis in those countries 15 done by using PubMed database up to September 2011, Most relevant data are at least 10 years old

From the literature reviews they found, they concluded that there is a need for epidemiological data representative of this region's adult population. Such data will enable the proper development of guidelines, allocation of resources, and the development of appropriate public health programs. (3)

1.3.4.11 Prevalence and Severity of Gingivitis in High School Students in Gaza Strip - Palestine

By Cross-sectional Study Background: There are limited data about the epidemiology of gingivitis in Gaza Strip, Palestine. The current study aimed to determine the prevalence and severity of gingivitis among high school students in Gaza strip. The findings of this study confirmed that the paternal educational level is considered a risk factor for gingivitis, where the students whose fathers have low educational levels have a higher probability of complaining from gingivitis than those whose fathers of high educational levels.(15)

1.3.5 Fixed orthodontic appliance

Since the era of Edward Hartley Angle, widely recognized as the pioneer of modern orthodontics beginning in 1899. Attachments in orthodontics can be bonded called brackets or tubes or banded called bands. Orthodontic appliances are creating a network on dentition which can aggravate the stagnation of foods.(56)

The brackets and molar tube occupy less surface area over the crowns of dentition as compared bands. (57)

Orthodontic brackets have undergone considerable advancements. Initially succeeded by the McLaughlin, Bennett, Trevisi bracket system, subsequent innovations introduced lingual brackets. These advancements have significantly streamlined the work of orthodontists. As the demographic seeking orthodontic treatment expands to include a growing number of adults, there is a heightened demand not only for improved dental alignment but also for enhanced aesthetics. Historically, the presence of fixed orthodontic appliances has often led to specific anxieties among patients. Balancing the desired aesthetics for patients with the technical performance required by orthodontists has posed a persistent challenge. Various strategies have been explored to address this challenge, such as altering the appearance or reducing the size of stainless steel brackets, shifting the appliance towards the lingual aspect of the teeth, and modifying bracket components. While smaller stainless steel brackets are increasingly prevalent and typically meet orthodontists' technical standards, they offer limited cosmetic advantages compared to equipment of the same size(58)

Braces serve as a valuable solution for correcting various forms of dental misalignment, yet traditional metal braces may not be preferred by everyone. While some individuals are comfortable with metal brackets and components, others may feel uneasy about them. To accommodate diverse patient preferences and financial considerations, orthodontists have developed a wide range of bracket styles. Each type of dental bracket offers distinct advantages, catering to specific needs. The field of orthodontic supplies and materials is continually evolving with rapidly advancing technology, leading to the emergence of new technologies, processes, and designs on a daily basis. These advancements aid orthodontists in achieving optimal functional and cosmetic outcomes for their patients. From the era of Edward Hartley Angle to the development of MBT brackets and subsequently lingual brackets, orthodontic bracket technology has progressed significantly, greatly simplifying orthodontists' work. As technology continues to advance, numerous new materials and designs are expected to emerge. (59)

The adult demographic seeking orthodontic treatment has witnessed a notable increase, attributed to several factors including heightened awareness of orthodontic options, advancements in appliance designs, the introduction of tooth-colored braces, improved financial capabilities, greater accessibility to qualified orthodontic professionals, and widespread media campaigns. These factors collectively contribute to the growing acceptance and uptake of orthodontic treatment among adults.(60)

As well as the effects of orthodontic treatments on periodontal improvement, remains unclear in the literature, there is a well-documented interaction between Orthodontics and Periodontics. Potential contributions of Orthodontics to the field of Periodontics include:

1. Facilitating better oral hygiene by providing well-shaped dental arches, eliminating dental crowding which can serve as a facilitator for malocclusion and periodontal disease.
2. Enabling vertical occlusal impact parallel to the long axes of the teeth, thereby ensuring uniform distribution of muscle forces throughout the dental arch.
3. Contributing, alongside prosthetic rehabilitations, to restoring normal vertical dimension.
4. Allowing for the achievement of an adequate dental crown-root relationship through induced orthodontic extrusion in selected cases, without bone loss.
5. Correcting or improving bone vertical defects through dental uprighting in selected cases.
6. Improving the positioning of prosthetic pillars for fixed prostheses and adjacent teeth of osseointegrated implants.

7. Decreasing or eliminating effects of bruxism, such as pain or muscle spasms, during orthodontic therapy.
8. Utilizing current orthodontic technology and proper planning and execution to achieve precise, light, and efficient orthodontic movements.

In summary, orthodontic treatment is indicated when the periodontal inflammatory/infectious process is controlled, and periodontal health is stabilized. However, orthodontic movements in periodontally susceptible or compromised patients in an active state of inflammation/infection significantly increase the risk of attachment loss and bone loss. In extreme cases, these movements can lead to periodontal collapse and necessitate tooth extraction.(61)

Gingival hyperplasia is a common complication associated with orthodontic treatment, often manifesting one to two months after appliance placement. Persistent hyperplasia or inflammation of the gingiva can impede orthodontic progress and elevate the risk of relapse, potentially leading to attachment loss. Thus, professional periodontal maintenance, including scaling, is crucial during active orthodontic treatment, especially when orthodontic intrusion is employed, as it may promote plaque migration from supragingival to subgingival regions, creating angular defects.

To mitigate such complications, the frequency of periodontal maintenance by scaling and root planning should be doubled for patients undergoing orthodontic treatment compared to those not undergoing orthodontic intervention.

The primary goal of periodontal therapy is to attain complete periodontal health and preserve the integrity of tooth attachment. Similarly, orthodontic treatment aims to enhance facial and dental aesthetics while restoring masticatory function. Orthodontics and periodontics are intricately intertwined within the oral cavity, with dental plaque, a complex bacterial biofilm, considered the primary etiological factor in dental caries and periodontal disease. Fixed orthodontic appliances are known to increase the risk of plaque accumulation.

Tooth movement in fixed orthodontic therapy relies on the remodeling properties of the periodontium. Consequently, orthodontic biomechanics and treatment planning are heavily influenced by periodontal factors, such as root length, alveolar bone support, and gingival structure.

In clinical practice, orthodontic intervention in periodontally susceptible or compromised patients with malocclusion should only proceed once the periodontal inflammatory/infectious process is controlled, and a stable periodontal condition is established. Effective control of periodontal microbiota is achieved through the elimination or significant reduction of periodontal pockets.

1.3.5.1 Current Updates on the Orthodontic-Periodontic Interrelationship

Cooperation, coordination, and interaction between different specialties in dentistry are extremely important in establishing diagnosis and treatment planning. The interrelationship between orthodontics and periodontics often resembles symbiosis. In many cases, periodontal health is improved by orthodontic tooth movement, whereas orthodontic tooth.(28)

Orthodontic treatment using fixed multi-banded appliances has gained popularity among adults, highlighting the increasing importance of periodontal factors for orthodontists. When treating adult patients, particularly those with compromised periodontal health, orthodontists must consider essential periodontal factors to ensure the maintenance of a healthy periodontium during and after treatment. Minor periodontal surgeries, such as pericisions, may be necessary to prevent relapse post-orthodontic treatment. Moreover, since periodontal diseases can contribute to malocclusion, orthodontic intervention can be crucial for successful periodontal therapy.

Collaboration between periodontists and orthodontists is essential for optimal outcomes in adult orthodontic treatment. Interdisciplinary cooperation between these specialties, combined with clinical expertise, can transform patients with aesthetically displeasing dentitions and compromised periodontal health into individuals with attractive smiles and healthy dentitions.

However, conflicting reports exist in the literature regarding the role of orthodontic therapy in the initiation and progression of periodontal disease. Some researchers suggest that orthodontic appliances not only promote bacterial accumulation but also facilitate the transition of subgingival plaque to more periopathogenic flora, potentially leading to the conversion of gingivitis to periodontitis.(62)

1.3.5.2 Orthodontic bands

An orthodontic band is a thin, seamless metal cylindrical ring, typically crafted from stainless steel, utilized to secure orthodontic attachments to a tooth. Primarily, modern bands are affixed to the maxillary or mandibular molars, although they may also be placed on other teeth with surfaces or shapes unsuitable for bonded brackets. Some orthodontists apply bands to mandibular premolars due to their increased bracket bond failures during treatment. Prior to the advent of directly bonding brackets to enamel, orthodontic bands were the conventional method of attaching appliances to teeth. Bands encircle the tooth, relying on a precise, custom fit and luting cement to ensure secure placement. The luting cement fills and seals irregular spaces between the band and the tooth surface. While luting cements typically do not adhere well to tooth or band materials, some newer banding cements exhibit improved adhesive characteristics.

The current preformed steel bands came into use during 1960s. Teeth receiving heavy intermittent forces, needing both labial and lingual attachments and teeth with short clinical crowns are few indications for banding. Unlike directly bonded attachments, where one size fits all, bands have to be customized according to the size of the tooth to which they are to be cemented. (63)

With the introduction of bondable brackets, the widespread use of orthodontic bands on all teeth has diminished. However, bands remain the preferred option in various scenarios. They offer greater strength and resistance to displacement compared to bonded brackets. Bands also serve as a convenient platform for soldered appliances such as palatal expansion appliances, Nance holding arches, and fixed lingual arches. Moreover, bands facilitate the straightforward spot welding of numerous attachments on both the facial and lingual aspects of teeth.

Originally, orthodontic bands were crafted from precious metal alloys, notably gold. However, stainless steel was later introduced as a more cost-effective alternative to gold alloys. When selecting a band alloy, engineers considered the properties required for optimal functionality in the oral environment and for easy adaptation to the diverse sizes and shapes of teeth. Teeth exhibit variable anatomy unique to each patient, including tapered crown forms and compound curves, necessitating a highly formable and adaptable material. Initially, bands were individually customized for each patient's tooth using a ribbon of band material supplied in rolls. A portion of the ribbon was stretched and shaped around the tooth (pinched), with the overlapping ends soldered together to form a complete ring, thus giving rise to the term "bands." This method was laborious and time-consuming, requiring skilled craftsmanship to produce well-fitting bands.

A well-fitted orthodontic band is crucial for resisting the forces generated by bite sticks, chewing, and attachments welded or soldered to the band. Bands are engineered to possess adequate strength, flexibility, weldability, and solderability while maintaining resistance against oral corrosion. Additionally, bands must not provoke allergic reactions in sensitive patients. Furthermore, the basic band alloy should be cost-effective and easily fabricated into bands.(64)

Bands on molars are indicated due to large forces they receive during fixed appliances like headgear or lip bumper; large restoration in molars; and need of lingual attachments like transpalatal arch and lingual arch. (65)

Orthodontic banding can adversely affect the gingival health in patients receiving fixed appliance treatment. Lack of proper oral hygiene maintenance further aggravates poor gingival health. (17)

Due to plaque accumulation gingival inflammation and hyperplasia can be seen in orthodontic patients. In case of negligence in maintaining good oral health the molar bands results in gingivitis and periodontitis.(66)

Gingivitis is reversible condition with no loss of attachment while periodontitis is an irreversible condition with clinical attachment loss.

From the main disadvantages of banding is the painful experience both before and during the procedure and the higher risk of bacteremia.(67). Molar banding takes additional chair side time and also an additional appointment which is necessary for prior separation of the adjacent teeth.(68)

1.3.5.3 Orthodontic bonds (tubes)

A molar tube is a metal tube that is placed to the outer surface of molars. It serves as a point of connection for the archwire, allowing it to slide when the teeth shift position. The categorization of these objects can be determined by their mode of attachment, such as being weldable able to be welded onto bands or bondable able to be bonded to the tooth surface. They can also be classified based on the shape of their lumen, which can be round, oval, or rectangular. Additionally, they can be categorized by the number of tubes they have, which can be single, double, or triple. Lastly, they can be classified based on the technique or prescription used, such as Begg tube, edgewise tube (with 0° tip and torque values), or pre-adjusted edgewise (with prescribed in-out, tip, and torque values). Historically, orthodontists favored the practice of using bands to secure molar teeth in fixed appliance therapy. However, in recent times, the use of molar tubes has grown in favour and has become a common practice, particularly due to advancements in adhesive systems.

Bonding molars offers several advantages compared to banding. The advantages of this include improved oral hygiene, resulting in reduced plaque accumulation, gingival inflammation, and periodontal problems. Patients at risk of bacteremia no longer need antibiotic prophylaxis. The elimination of painful banding experiences increases patient comfort. Separators and the spaces caused by bands are no longer necessary. There is also an improvement in aesthetics. Chairside time is reduced, allowing the bonding procedure to be completed in a single visit. Additionally, caries detection becomes easier.

On the other hand the banded molars showed a statistically higher post treatment value of periodontal probing depth as compared to the molars with bonded attachments. (69)

1.3.5.4 Adhesives in orthodontics

The efficacy of a fixed orthodontic appliance hinges on the secure bonding of metal brackets to the teeth to prevent debonding and protect against caries (decay) throughout the treatment period. Minimizing the rate of bracket failure is essential, as frequent bracket replacements during the typically lengthy treatment duration of around two years can impede treatment progress and incur additional clinical time, materials, and potential patient education/work disruptions.

Orthodontic brackets endure numerous forces within the oral cavity, resulting in a complex stress distribution within the adhesive and its interfaces with the tooth surface and bracket base (Sunna, 1998). Ideally, the adhesive should exhibit the following characteristics:

- Sufficient strength to maintain bracket adhesion throughout the treatment duration.
- Gentle enough to prevent damage to the tooth surface upon removal of the appliance.
- Clinically acceptable for clinician and patient.
- Protective against dental caries.
- Economically viable.

Currently available adhesives for bonding brackets to teeth typically consist of resin-based compositions resembling 'white' filling materials (composites) or formulations supplied as powder and liquid. Recent advancements have led to the development of polyacid-modified resin composites (compomers) and resin-modified glass ionomer cements by modifying traditional composites and glass ionomers, respectively. These adhesives can be cured chemically or activated via light curing by exposing them to blue light. (Mandall et al., 2018)

As adhesive systems evolved, bonding attachments to molars has become a routine procedure, reducing the duration of clinical care and facilitating oral hygiene. (71) Current data, however, indicate that routine bonding of first or second permanent molars has almost doubled in recent years. (10)

2

Questions

2 QUESTIONS

1. Are there differences in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **cemented bands**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months)?
2. Are there differences in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **bonded tubes**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months)?
3. Are there any differences in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **cemented bands in comparison to bonded tubes**, with variations attributed to duration (T0, T3, and T6 months)?

3

Hypothesis

3 HYPOTHESIS

1. "There is no statistically significant difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **cemented bands**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months)."
2. "There is no statistically significant difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **bonded tubes**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months)."
3. "There is no statistically significant difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **cemented bands in comparison to bonded tubes**, with variations attributed to duration (T0, T3, and T6 months)."

4

Objectives

4 OBJECTIVES

1. To test the difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **cemented bands**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months).
2. To test the differences ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **bonded tubes**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months).
3. To test the differences difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, plaque, bleeding on probing and probing depth) for **cemented bands in comparison to bonded tubes**, with variations attributed to duration (T0, T3, and T6 months).

5

Materials and methodology

Sections of this chapter has already been published as:

Almughany, M., Banded vs. Bonded: Which Orthodontic Attachment Preserves Periodontal Health, Six Months study. *International Journal of Oral Health Dental Management*, 2025. 3 (2), 1-8.
[https://doi .10.64030/2577-6533](https://doi.10.64030/2577-6533)

Almughany, M., et al., Evaluating the effects of Orthodontic Banding on Gingival Health: A Six-Months Study. *Journal of Dentistry and Oral Health*.2025. 12: 1-12
<https://doi.10.17303/jdoh.2025.12.201>

5 MATERIALS AND METHODOLOGY

5.1 STUDY DESIGN

The study was designed as a clinical trial. This was achieved by fixing the upper right-side first molar with a cemented band and the other upper left-side first molar with a bonded tube. This method has ensured that both units are subject to the same environmental conditions, minimizing potential external variables.

5.2 STUDY POPULATION

During the data collection period, every patient aged between 12 and 35 years who visited the researcher's private clinic seeking orthodontic treatment and met the inclusion criteria was informed about the study. Upon accepting participation and signing the consent form, they underwent oral hygiene assessment, gingival scaling, and were given oral hygiene instructions before being prepared for appliance fixation

5.3 STUDY SETTING

The study was conducted in the researcher's private clinic (Siwak Dental Clinic) in Gaza strip, Palestine.

5.4 STUDY PERIOD

The study period between September 2023 till November 2024.

5.5 SAMPLING AND SAMPLE SIZE

Selection of Patients came to Researcher's clinic from 05.03.2024 to 04.05.2024 who seeks orthodontic treatment by Fixed appliance. 60 teeth from 30 participants.

5.6 MATERIALS

This research proposed to use the following materials related to Fixed orthodontic appliance:

- 1- Fixed Orthodontic appliance:
 - a) **American Orthodontic Appliance, Master/Mini series, slot size 0.22(72)**



Figure 1: American Orthodontic Appliance

Characteristics of American orthodontic appliance:

- Optimum bracket widths achieve excellent torque and rotational control, with adequate inter bracket space for free tipping.
- Improved rotational control due to the base radius being machined into the part rather than formed after the slot is cut.
- Reduced mesial/distal and occlusal/gingival dimensions allow earlier bonding of severely rotated teeth.

- b) **American Orthodontic bonds (Tubes).(73)**



Figure 2: Orthodontic Tube (American Orthodontic tube)

Direct bonded molar tubes offer several advantages including decreased inventory demands, enhanced patient comfort and hygiene, as well as expedited bonding and debonding processes. Orthodontists worldwide are increasingly recognizing the merits of utilizing direct bonding techniques for molars.

- Streamlines the chair-time, financial resources, and logistical challenges associated with banding.
- Eliminates the need for a separate appointment for separator placement.
- Enhances patient comfort during treatment.
- Exhibits stronger bonding properties when used with contemporary adhesives.
- Diminishes the expenses and complexities associated with maintaining large band inventories.

c) 3M-style metal bands: (73)



Figure 3: Orthodontic band (3M style)

The 3M™ Unitek™ General Purpose Molar Bands consist of individual wide bands, accessible in hard temper. Kits are exclusively available in regular temper.

Key features of these bands include:

- Medium contour design, offering medium-high tooth coverage to accommodate various crown shapes effectively.
- Medium stiff temper, constructed from a robust material suitable for utilization with welded appliances requiring higher forces.
- Universal anatomy designed to fit both right and left sides with minimal burnishing required.

- Permanent laser identification for clear identification.
- Available in narrow or wide configurations to cater to different clinical needs.

d) American Orthodontic archwire:(72)



Figure 4: AO-Product-Catalog

- Fully active at room temperature
- Exhibits excellent springback
- Gentle to patients, but powerful enough to align even the most challenging cases
- Moderate forces are an excellent choice for all treatment phases except finishing

e) ligatures:(74)



Figure 5: Elastic ligature for fixed appliance

Orthodontic ligatures have an important role during edgewise bracket sliding along a continuous archwire, the function of constituting the connection between the bracket and

orthodontic archwire. There are two types of orthodontic ligatures: heat-treated stainless steel and elastomeric rings. The former are modelled from a steel wire of a diameter between 0.008 and 0.014 inches. They ensure a sufficiently rigid and stable ligation between orthodontic bracket and archwire, though favouring the development of significant friction levels during mechanical sliding (75). Elastomeric ligatures are manufactured in different morphological modules (ellipsoid or circular), with different diameter and width, with rough or smooth surface.(76)

2) Acid Etching: FineEtch (37% phosphoric acid) (77)



Figure 6: Spident (FineEtch) acid etching

Acid etching of tooth surfaces to promote the bonding of orthodontic attachments to the enamel has been a routine procedure in orthodontic treatment since the 1960s. Various types of orthodontic etchants and etching techniques have been introduced in the past five decades.(78)

Acid etching in dentistry is an effective way to bond different types of restorations to enamel or dentin. The "smear layer" of organic and inorganic material on a tooth, which results from cavity prep, makes for a less than ideal surface for bonding. Because of the need to "disrupt" this smear layer.

FineEtch contains 37% phosphoric acid and supplies semi-gel consistency for ideal applications.

Bio-compatible polymeric materials contained, Complete residue-free after water-spray, Excellent viscosity, Effectively removes smear layers and creates the ideal bonding surfaces on dentin use for enamel and dental posts.

3) Adhesives:

a) GC Ortho Connect™ adhesive: (79)



Figure 7: GC Ortho connect Adhesive

Launched in August 2013 in Japan under the name of Universal Bond, GC has decided through GC Orthodontics to launch GC Ortho Connect on the European Orthodontic market. GC Ortho Connect is a new orthodontic light-cured adhesive for brackets and bondable buccal tubes.

Safe bonding with:

- Metal brackets & bondable buccal tubes
- Ceramic brackets
- Plastic and Hybrid Brackets

b) Riva self-cure (SDI) glass ionomer luting cement: (80)



Figure 8: Riva Luting Cement

Product Information

glass ionomer luting cement with fabulous fluoride release. Riva Luting is a conventional, self curing, glass ionomer luting cement designed for final cementation of metal based restorations. It chemically bonds to metal substrates and the tooth.

Indications:-

Cementation of metal or porcelain fused to metal inlays, onlays and crowns
 Cementation of stainless steel crowns, Cementation of posts and screws and attachment of metal orthodontic bands Lining

4) Periodontal Probe:(81)

- The University of Michigan O probe with Williams markings (at 1, 2, 3, 5, 7, 8, 9) 4 and 6 missing.



Figure 9: University of Michigan O probe with Williams markings.

5) International periodontal diagnostic chart: (82)



Periodontal Chart Examination for PhD research Requirement

Researcher: Mahmoud N. Almughany

Participants Name:, Sex: M, F, Age:Y, Participants No:

Examination Date:/...../2022

	16	26
Gingival margin		
Plaque		
Gingival index		
Bleeding on probing		
Probing depth		
Buccal		
Palatal		
Gingival margin		
Plaque		
Gingival index		
Bleeding on probing		
Probing depth		



Figure 10: Online chart, modified and printed to be suitable for research, and used to record gingival parameters readings.

6) Excel sheet to save the readings:

Data Collection																										
No.	Patient name	Upper right first molar (Banded)										Upper right first molar (Bonded)														
		Gingival margin		Plaque		Bleeding on probing		Probing depth				Gingival margin		Plaque		Bleeding on probing		Probing depth								
		buccal	Lingual	buccal	Lingual	buccal	Lingual	MB	B	DB	ML	L	DL	buccal	Lingual	buccal	Lingual	buccal	Lingual	MB	B	DB	ML	L	DL	
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Figure 11: An Excel sheet done to record the readings to transfer it easily to SPSS

5.7 STATISTICAL ANALYSIS

The following statistical analysis tests used to analyse the data using IBM SPSS Statistics 21

1. Chi-Square Test:

It is a statistical procedure for determining the difference between observed and expected data. This test can also be used to determine whether it correlates to the categorical variables in our data. It helps to find out whether a difference between two categorical variables is due to chance or a relationship between them.

2. The two-sample t-test:

It is used to determine if two population means are equal. A common application is to test if a new process or treatment is superior to a current process or treatment. There are several variations on this test.

3. Repeated-measure test:

It is a research design in which subjects are measured two or more times on the dependent variable. Rather than using different participants for each level of treatment, the participants are given more than one treatment and are measured after each.

4. Paired T-Test:

The paired sample t-test, sometimes called the dependent sample t-test, is a statistical procedure used to determine whether the mean difference between two sets of observations is zero. In a paired sample t-test, each subject or entity is measured twice, resulting in pairs of observations.

5. The Repeated measures ANOVA:

It is a procedure analyses groups of related dependent variables that represent different measurements of the same attribute. Note that the order in which you specify within subjects factors is important. Each factor constitutes a level within the previous factor.

5.8 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 or parents of the young, aged patients were provided information about the study and informed signed consent was obtained prior to their inclusion in the study. Participants was chosen according to the eligibility criteria.

5.8.1 Eligibility criteria for participants selection

Some criteria are used to select the participants, some rules should be in the participants to be included in the research, other will not.

a) The inclusion criteria:

- Patients with no current periodontitis.
- Patients with no orthodontic treatment done before.
- Patients with no Perio treatment done at least before 6 months.
- Patients with No smoking habit.
- Patients are free from any systemic diseases.

- For female patients, no pregnancy.
- Patients Aged 12 – 35 years.

b) The exclusion criteria:

- Patients with missing maxillary first molars.
- Patients requiring arch expansion or distalization of molars with auxiliary appliances .
- Patients with systemic diseases, and patients on antibiotics within 3 months.

At the beginning, before banding or bonding the upper first molars, teeth were checked for gingival parameters such as Gingival margin, Gingival index, Plaque index, bleeding on probing and probing depth and this is considered the first stage in the research and denoted as (T0)

After that fixed orthodontic appliances using American orthodontic brackets (AO) were bonded normally from the second premolar to the opposing second premolar.

• **Brackets and molar tube bonding protocol:**

- Cleaning the molar buccal surface by non-fluoridated tooth paste using a low speed rubber cup for 10 secs, rinsed water for 10 secs and gentle dryness for 10 secs.
- Enamel etching by using FineEtch (37% phosphoric acid) for 30 seconds.
- Washing for 10 secs and drying for 10 secs.
- Placing of GC primer on the etched area of the tooth.
- Gentle air flow for 10 seconds, light curing for 10 sec using by (woodpecker light cure).
- Placing adhesive material GC Ortho Connect on the metal tube base.
- Positioning the tube on the buccal surface of the crown.
- Gentle pressure on the bracket to spill the excess material.
- Adjust the tube to the suitable position.
- Remove of the excess adhesive material by sharp explorer.

- Light curing for 40 seconds, each side 10 seconds by (woodpecker light cure).
- The upper left first molar was bonded by AO tube style using GC ortho connect adhesive.

- **Molar band cementation protocol:**

- Separation of adjacent teeth can be achieved using separators for a duration of 2 to 7 days before banding cementation time.
 - Cleaning the molar buccal surface by non-fluoridated tooth paste using a low speed rubber cup for 10 secs, rinsed water for 10 secs and gentle dryness for 10 secs.
 - Selection of suitable band to be well adapted around molar tooth surfaces.
 - Washing for 10 secs and drying for 10 secs.
 - Mixing the Riva self-cure glass ionomer luting cement powder and liquid until be homogenous creamy mix.
 - Placing the cement material in the interior borders of the band.
 - The band is adapted around the molar tooth using a band pusher.
 - Adequate moisture control is essential during cementation.
 - Excess cement can be removed using an explorer after the initial set of the luting cement.
- The upper right first molar was banded by a 3M style metal band and cemented by Riva self-cure (SDI trademark) glass ionomer luting cement.
 - The participants were given instructions about:
 - a. proper and thorough oral hygiene
 - b. proper and balanced dietary habits (primarily decreased frequency of sugar consumption).
 - c. Informed them to invest extra time and effort in performing oral hygiene because they considered a distinct group of high-risk patients for dental

disease. This will provide the same environment for the banded and bonded first molars for the same participant.

- After three months of the first stage (T0), the gingival parameters for the upper first molars (banded and bonded teeth) were checked for the second time and denoted as (T3).
- And the same is repeated after 6 months from the beginning of treatment and this is denoted as (T6).
- For each stage, the University of Michigan O probe with Williams markings were used to check the parameters and mark them on an international periodontal diagnostic chart.
- After that all the data collected and moved to an excel sheet to be ready for statistical analysis.



Figure 12: Images shows the placement of molar bands on the upper right first molar and the bonded tube on the upper left first molar (Created by the Author: Mahmoud N. Almughany)

5.8.2 Clinical Evaluations

Clinical examinations of gingival parameters such as Gingival margin, Gingival index, Plaque index, probing depth and bleeding on probing were conducted by a calibrated examiner under constant lighting conditions. Upper first molars (banded and bonded) were examined and international indices were used to measure these findings:

1) Gingival Margin:

a) Miller's classification for gingival recession:

- Class I: Marginal tissue recession that does not extend to the mucogingival junction. There is no loss of bone or soft tissue in the interdental area. This can be narrow or wide.
- Class II: Marginal tissue recession that extends to or beyond the mucogingival junction. There is no loss of bone or soft tissue in the interdental area. This can be narrow or wide.
- Class III: Marginal tissue recession that extends to or beyond the mucogingival junction. In addition, there is loss of bone and/or soft tissue in the interdental area or there is mispositioning of the tooth.
- Class IV: Marginal tissue recession that extends to or beyond the mucogingival junction with severe loss of bone and soft tissue interdentally and/or severe mispositioning of the tooth.

b) Millers and Damm classification for gingival enlargement: (1992)

The vertical growth (overgrowth index) is described as:

- Grade 0 : Normal gingival , No alterations
- Grade 1: minimal overgrowth ≤ 2 mm, gingival covering the cervical third or less of the anatomical crown.
- Grade 2: moderate overgrowth, 2 to 4 mm gingival covering the middle third of the anatomical crown.
- Grade 3: severe overgrowth ≥ 4 mm nodular growth, gingival covering more than thirds-two of the dental crown.

Note: in this research, using the following before the grade or class numbers

- **(+)** before the number means gingival enlargement as +1,+ 2 , +3
- **(-)** before the number means gingival recession as -1, -2, -3

2) Gingival index:

The scoring scheme for gingival index was (Loe & Silness 1963) scheme:

- Score 0: Absence of inflammation/normal gingiva.
- Score 1: Mild inflammation, a slight change in colour, slight oedema, no bleeding on probing.
- Score 2: Moderate inflammation, moderate glazing, redness, oedema and hypertrophy, bleeding on probing.
- Score 3: Severe inflammation, marked redness and hypertrophy, ulceration, spontaneous bleeding.

3) Plaque Index:

The scoring scheme for Plaque index was (Silness & Loe 1964) scheme:

- Score 0: No plaque.
- Score 1: Good - A film of plaque adhering to free gingival margin and adjacent area of the tooth. The plaque is felt only by running a probe across the tooth surface.
- Score 2: Fair - Moderate accumulation of soft deposits without the gingival pocket on the gingival margin and/or adjacent tooth surface which can be seen by the naked eye.
- Score 3: Poor - Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

4) Bleeding on probing:

The scoring scheme for Bleeding on probing was (Ainamo and Bay) scheme:

The index was developed as an easy and suitable way for the practitioner to assess a patient's progress in plaque control. 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, which is expressed as a percentage of the total number of gingival margins examined.

Note: in this research the following was used:

- (+) means there is bleeding.
- (-) means there is no bleeding.

5) Probing depth:

Probing or Pocket depth (PD), measured with The University of Michigan O probe with Williams markings (at 1, 2, 3, 5, 7, 8, 9) 4 and 6 missing, recorded as the distance from the gingival margin to the most apical part of the sulcus. Six readings were carried out per tooth (mesiobuccal, buccal, distobuccal, mesiolingual, lingual, distolingual) and average number registered for all of these readings.

6

Results

Sections of this chapter has already been published as:

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[https://doi: 10.21276/jamdsr](https://doi.org/10.21276/jamdsr).

Almughany, M., et al., Evaluating the effects of Orthodontic Banding on Gingival Health: A Six-Months Study. *Journal of Dentistry and Oral Health*.2025. 12: 1-12
[https://doi.10.17303/jdoh.2025.12.201](https://doi.org/10.17303/jdoh.2025.12.201)

Almughany, M., Banded vs. Bonded: Which Orthodontic Attachment Preserves Periodontal Health, Six Months study. ***International Journal of Oral Health Dental Management*, 2025. 3 (2), 1-8.**
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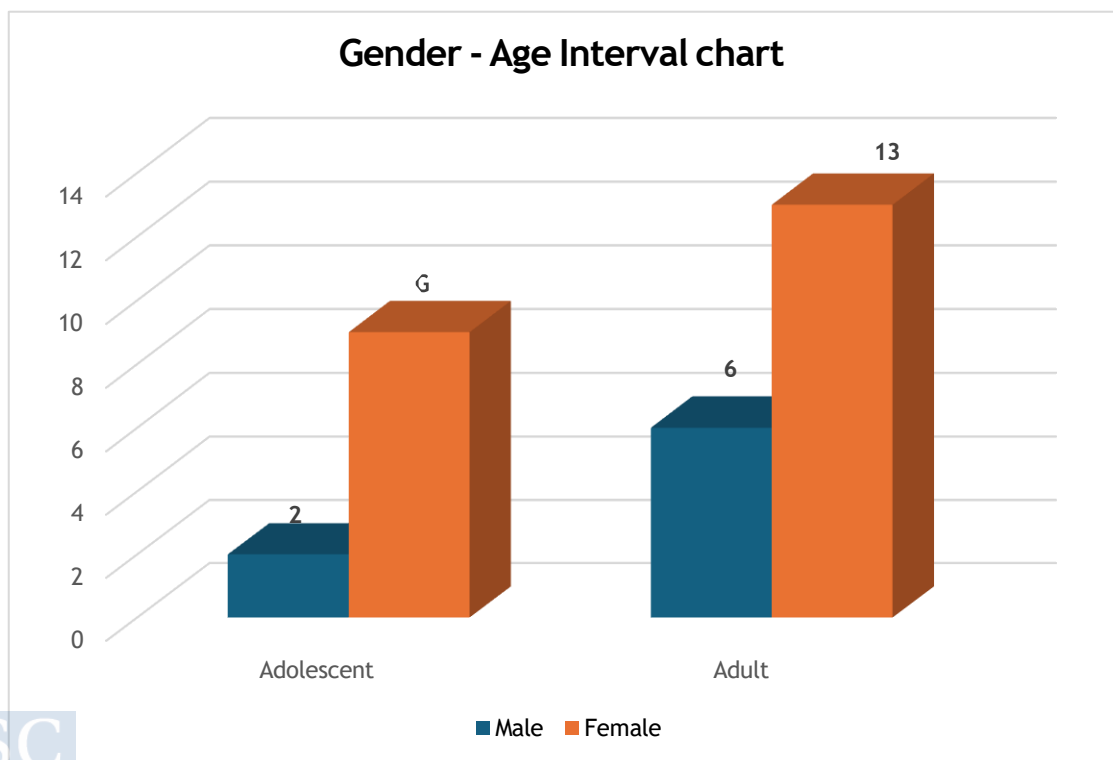
Almughan,M., Orthodontic Banding and Gingival Health: A Six-Months Study from Gaza Strip, Palestine *Online Journal of Dentistry & Oral Health*. 2025. 9(1): 2025.
[https://doi: 10.33552/OJDOH.2025.08.000702](https://doi.org/10.33552/OJDOH.2025.08.000702).

6 RESULTS

6.1 FREQUENCY TABLE

Table 1. Gender * Age Interval Crosstabulation

			Age Interval		Total
			Adolescent	Adult	
Gender	Male	Count	2	6	8
		% of Total	6.7%	20.0%	26.7%
Gender	Female	Count	9	13	22
		% of Total	30.0%	43.3%	73.3%
Total	Count		11	19	30
	% of Total		36.7%	63.3%	100.0%



6.2 HYPOTHESIS 1

Hypothesis 1

“There is no statistically significant difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, probing depth, plaque, and bleeding on probing) for **cemented bands**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months).”

6.2.1 Gingival parameters attributed to Gender for cemented bands.

Table 2. Gingival parameters attributed to gender for cemented bands 1.

		Group Statistics			
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Gingival Margin T0	Male	8	.0000	.00000 ^a	.00000
	Female	22	.0000	.00000 ^a	.00000
Plaque Index T0	Male	8	.0000	.00000 ^a	.00000
	Female	22	.0000	.00000 ^a	.00000
Gingival Index T0	Male	8	1.0000	.00000 ^a	.00000
	Female	22	1.0000	.00000 ^a	.00000
Bleeding on Probing T0	Male	8	2.0000	.00000 ^a	.00000
	Female	22	2.0000	.00000 ^a	.00000
Gingival Margin T3	Male	8	.0000	.00000	.00000
	Female	22	.0455	.21320	.04545
Plaque Index T3	Male	8	.7500	.88641	.31339
	Female	22	.8636	.88884	.18950
Gingival Index T3	Male	8	1.3750	.51755	.18298
	Female	22	1.5455	.50965	.10866
Bleeding on Probing T3	Male	8	1.6250	.51755	.18298
	Female	22	1.4545	.50965	.10866
Gingival Margin T6	Male	8	.0000	.00000	.00000
	Female	22	.0455	.21320	.04545
Plaque IndexT6	Male	8	1.1250	.83452	.29505
	Female	22	1.1818	.73266	.15620
Gingival Index T6	Male	8	1.3750	.51755	.18298
	Female	22	1.6364	.49237	.10497
Bleeding on Probing T6	Male	8	1.6250	.51755	.18298
	Female	22	1.3636	.49237	.10497
av_probingdepthT0	Male	8	1.0729	.35197	.12444
	Female	22	1.3220	.46950	.10010
av_probingdepthT3	Male	8	1.2396	.40931	.14471
	Female	22	1.5758	.57787	.12320
av_probingdepthT6	Male	8	1.4896	.37911	.13404
	Female	22	1.9545	.40231	.08577

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

Table 3. Gingival parameters attributed to gender for cemented bands 2.

	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	1.568	.221	-.596	28	.556	-.04545	.07623	-.20160	.11069
			-1.000	21.000	.329	-.04545	.04545	-.13998	.04907
Plaque Index T3	.047	.830	-.310	28	.759	-.11364	.36672	-.86482	.63755
			-.310	12.498	.761	-.11364	.36623	-.90807	.68080
Gingival Index T3	.744	.396	-.807	28	.426	-.17045	.21123	-.60315	.26224
			-.801	12.297	.438	-.17045	.21281	-.63289	.29198
Bleeding on Probing T3	.744	.396	.807	28	.426	.17045	.21123	-.26224	.60315
			.801	12.297	.438	.17045	.21281	-.29198	.63289
Gingival Margin T6	1.568	.221	-.596	28	.556	-.04545	.07623	-.20160	.11069
			-1.000	21.000	.329	-.04545	.04545	-.13998	.04907
Plaque index T6	.125	.726	-.181	28	.858	-.05682	.31353	-.69906	.58542
			-.170	11.181	.868	-.05682	.33385	-.79016	.67652
Gingival Index T6	.012	.915	-1.269	28	.215	-.26136	.20593	-.68319	.16046
			-1.239	11.935	.239	-.26136	.21095	-.72127	.19854
Bleeding on Probing T6	.012	.915	1.269	28	.215	.26136	.20593	-.16046	.68319
			1.239	11.935	.239	.26136	.21095	-.19854	.72127
av_probing depthT0	1.774	.194	-1.362	28	.184	-.24905	.18292	-.62375	.12564
			-1.559	16.664	.138	-.24905	.15970	-.58652	.08841
av_probing depthT3	2.527	.123	-1.506	28	.143	-.33617	.22323	-.79343	.12108
			-1.769	17.721	.094	-.33617	.19005	-.73591	.06357
av_probing depthT6	.025	.875	-2.839	28	.008	-.46496	.16376	-.80040	-.12952
			-2.922	13.171	.012	-.46496	.15913	-.80829	-.12163

Through the previous tables 2 & 3 , there is no significant differences between male and female regarding using cemented bands on gingival parameters.

6.2.2 Gingival parameters attributed to Age groups for cemented Bands

Table 4. Gingival parameters attributed to age groups for cemented bands 1.

Group Statistics					
	Age Interval	N	Mean	Std. Deviation	Std. Error Mean
Gingival Margin T0	Adolecent	11	.0000	.00000 ^a	.00000
	Adult	19	.0000	.00000 ^a	.00000
Plaque Index T0	Adolecent	11	.0000	.00000 ^a	.00000
	Adult	19	.0000	.00000 ^a	.00000
Gingival Index T0	Adolecent	11	1.0000	.00000 ^a	.00000
	Adult	19	1.0000	.00000 ^a	.00000
Bleeding on Probing T0	Adolecent	11	2.0000	.00000 ^a	.00000
	Adult	19	2.0000	.00000 ^a	.00000
Gingival Margin T3	Adolecent	11	.0909	.30151	.09091
	Adult	19	.0000	.00000	.00000
Plaque Index T3	Adolecent	11	.6364	.67420	.20328
	Adult	19	.9474	.97032	.22261
Gingival Index T3	Adolecent	11	1.4545	.52223	.15746
	Adult	19	1.5263	.51299	.11769
Bleeding on Probing T3	Adolecent	11	1.5455	.52223	.15746
	Adult	19	1.4737	.51299	.11769
Gingival Margin T6	Adolecent	11	.0909	.30151	.09091
	Adult	19	.0000	.00000	.00000
Plaque Index T6	Adolecent	11	1.4545	.52223	.15746
	Adult	19	1.0000	.81650	.18732
Gingival Index T6	Adolecent	11	1.6364	.50452	.15212
	Adult	19	1.5263	.51299	.11769
Bleeding on Probing T6	Adolecent	11	1.3636	.50452	.15212
	Adult	19	1.4737	.51299	.11769
av_probingdepthT0	Adolecent	11	1.1515	.40280	.12145
	Adult	19	1.3158	.47432	.10882
av_probingdepthT3	Adolecent	11	1.3485	.49275	.14857
	Adult	19	1.5658	.58173	.13346
av_probingdepthT6	Adolecent	11	1.8106	.50013	.15079
	Adult	19	1.8421	.41934	.09620

Table 5. Gingival parameters attributed to age groups for cemented bands 2.

	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	8.757	.006	1.332	28	.194	.09091	.06827	-.04893	.23075
			1.000	10.000	.341	.09091	.09091	-.11165	.29347
Plaque index T3	1.640	.211	-.937	28	.357	-.31100	.33194	-.99095	.36894
			-1.032	26.885	.311	-.31100	.30146	-.92967	.30766
Gingival Index T3	.041	.840	-.367	28	.716	-.07177	.19561	-.47247	.32892
			-.365	20.704	.719	-.07177	.19658	-.48094	.33740
Bleeding on Probing T3	.041	.840	.367	28	.716	.07177	.19561	-.32892	.47247
			.365	20.704	.719	.07177	.19658	-.33740	.48094
Gingival Margin T6	8.757	.006	1.332	28	.194	.09091	.06827	-.04893	.23075
			1.000	10.000	.341	.09091	.09091	-.11165	.29347
Plaque Index T6	.809	.376	1.654	28	.109	.45455	.27477	-.10830	1.01739
			1.858	27.611	.074	.45455	.24471	-.04703	.95612
Gingival Index T6	1.235	.276	.570	28	.574	.11005	.19322	-.28574	.50583
			.572	21.312	.573	.11005	.19233	-.28957	.50966
Bleeding on Probing T6	1.235	.276	-.570	28	.574	-.11005	.19322	-.50583	.28574
			-.572	21.312	.573	-.11005	.19233	-.50966	.28957
av_probing depthT0	2.314	.139	-.963	28	.344	-.16427	.17052	-.51358	.18503
			-1.007	23.932	.324	-.16427	.16307	-.50088	.17233
av_probing depthT3	1.958	.173	-1.040	28	.307	-.21730	.20898	-.64539	.21078
			-1.088	23.976	.287	-.21730	.19971	-.62951	.19490
av_probing depthT6	1.349	.255	-.185	28	.855	-.03150	.17044	-.38062	.31763
			-.176	18.128	.862	-.03150	.17887	-.40710	.34410

Through the previous table 4 & 5, there is no significant differences between adolescent and adults regarding using cemented bands on gingival parameters.

6.2.3 Gingival parameters attributed to duration for cemented bands

Gingival margin: Repeated Measure ANOVA

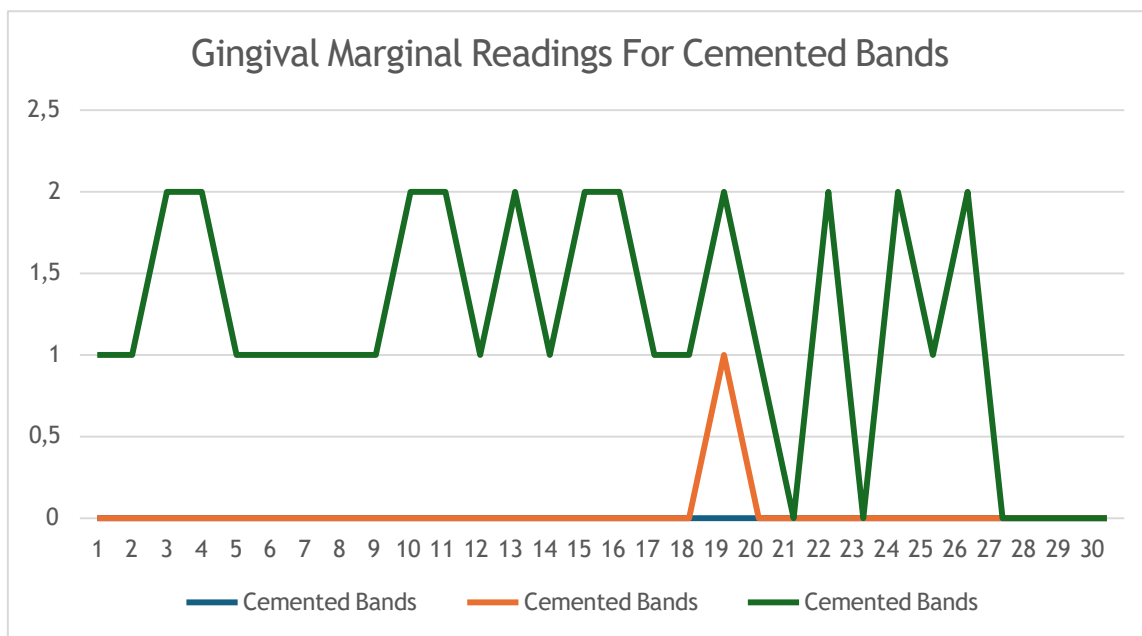


Figure 14: Descriptive statistics for Gingival marginal readings for cemented bands from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Table 6. Gingival Margin attributed to duration for cemented bands.

		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 ^a	30	.18257	.03333
	Gingival Margin T6	.0333 ^a	30	.18257	.03333
Pair 3	Gingival Margin T0	.0000	30	.00000	.00000
	Gingival Margin T6	.0333	30	.18257	.03333

a. The correlation and t cannot be computed because the standard error of the difference is 0.

From the previous table no. 6, the significance level value ($P = 0.326 > 0.05$) indicates that there is no statistically significant differences in the level of Gingival margin according to the duration of cemented bands using T0, T3 and T6 months.



Table 7. Source of differences for Gingival Margin

		Paired Differences					t	df	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

From the previous table no. 7, there is no statistically significant differences regarding Gingival Margin as ($P = 0.326 > 0.05$).

Plaque index: Repeated Measure ANOVA

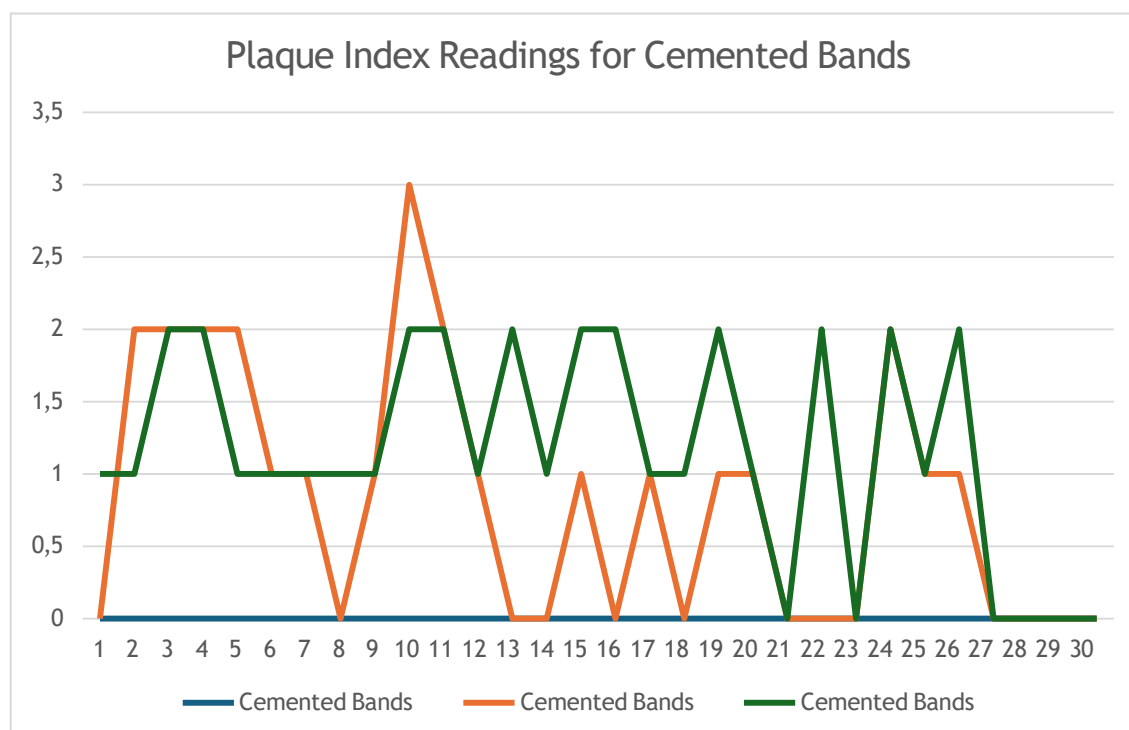


Figure 15: Descriptive statistics for Plaque Index readings for cemented bands from T0 - T6 (Created by the Author: Mahmoud N. Almughany)



Table 8. Plaque index attributed to duration for cemented bands.

		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

From the previous table no. 8, 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 therefore, In order to identify the source of the differences, the compare means paired-samples T Test was used.

Table 9. Source of differences for Plaque index (1).

		Paired Differences					t	df	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

From the previous table no. 9, 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

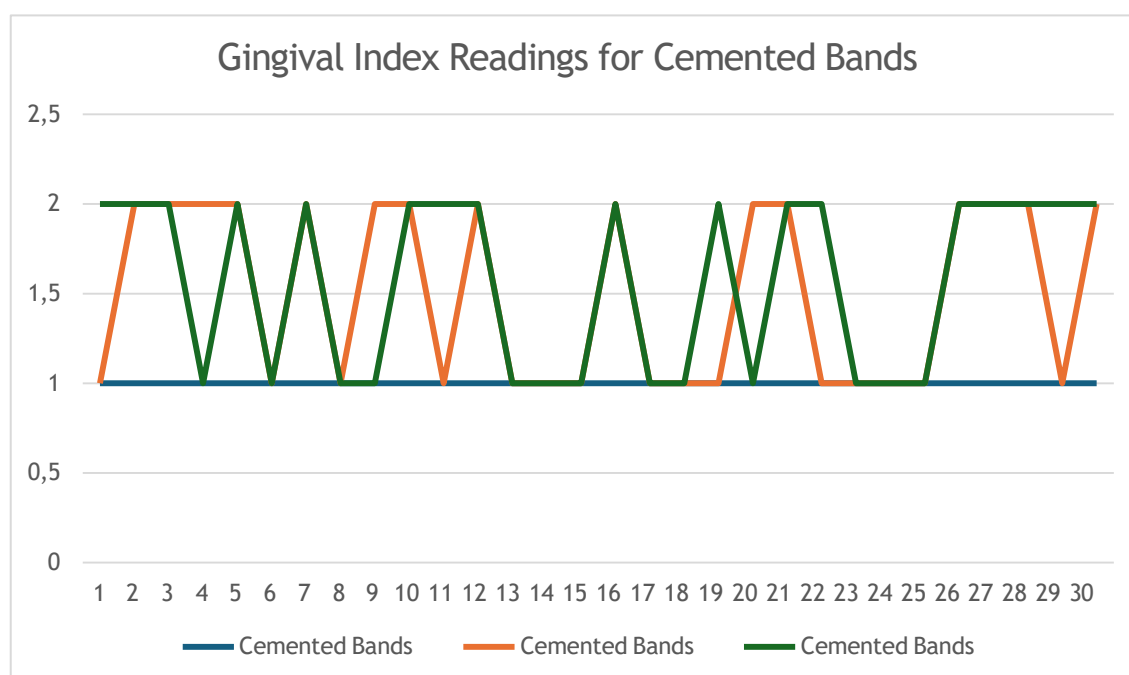


Figure 16: Descriptive statistics for Gingival Index readings for cemented bands from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Table 10. Gingival index attributed to duration for cemented bands.

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

From previous table no. 10, 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.

Table 11. Source of difference for Gingival index.

		Paired Differences					t	df	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

From the previous table no. 11, 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

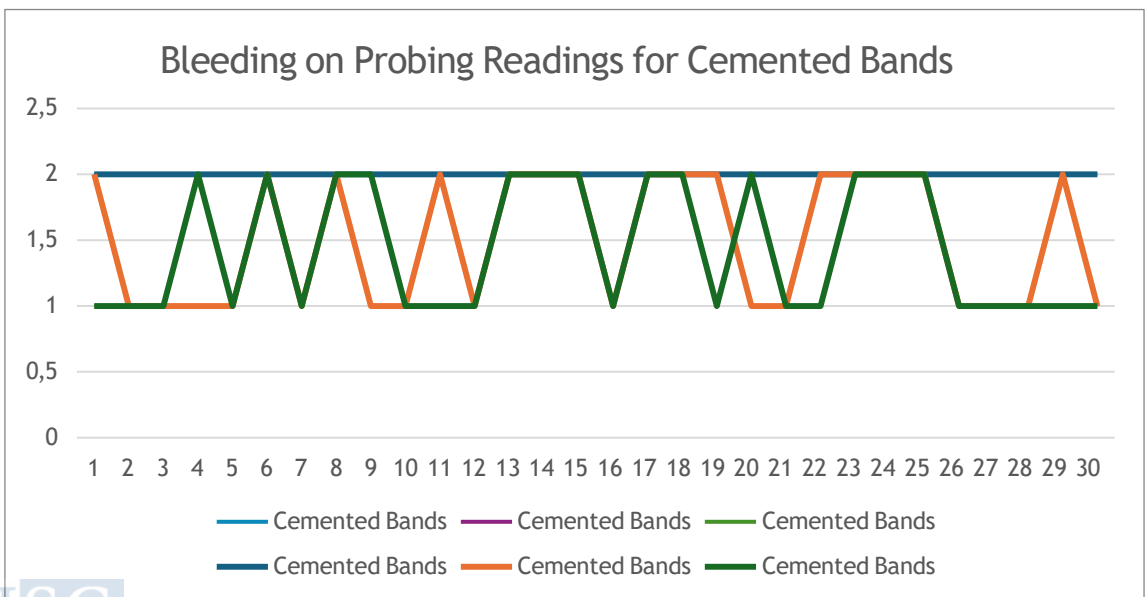


Figure 17: Descriptive statistics for Bleeding on Probing readings for cemented bands from T0 - T6 as 1 means bleeding, 2 means no bleeding (Created by the Author: Mahmoud N. Almughany)

Table 12. Bleeding on Probing attributed to Duration for cemented bands 1 .

Bleeding on Probing T3 * Bleeding on Probing T6 Crosstabulation

			Bleeding on Probing T6		Total
			Y	N	
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 13. 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 ^a	1	.010	.025	.013
Continuity Correction ^b	4.887	1	.027		
Likelihood Ratio	6.946	1	.008		
Fisher's Exact Test					
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 tables 12 & 13, 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.

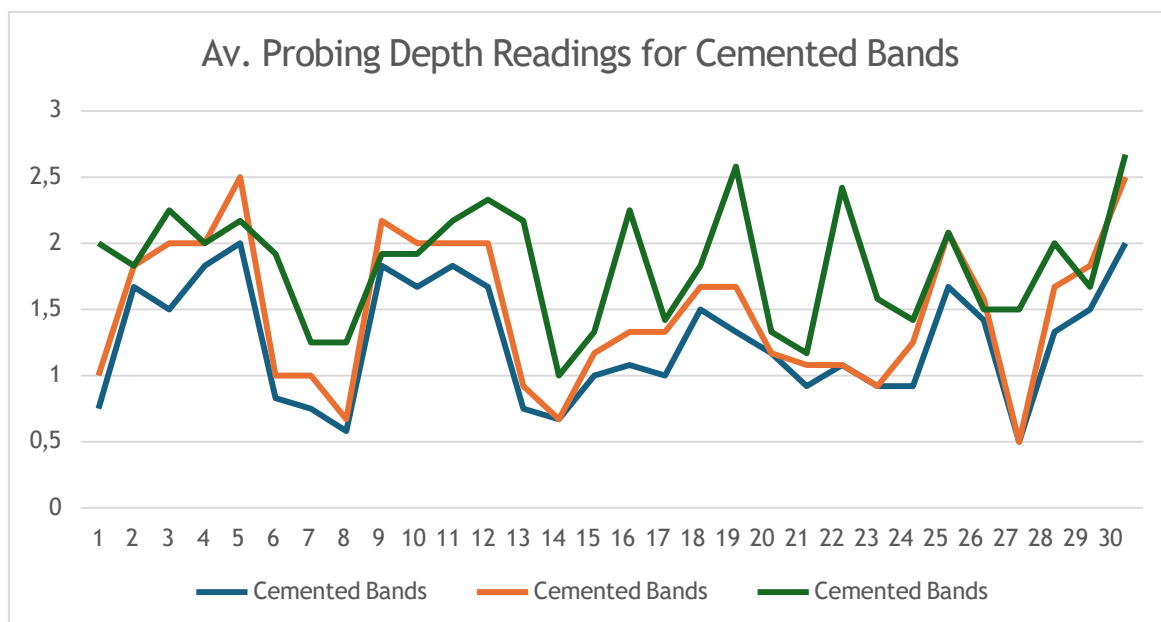


Figure 18: Descriptive statistics for Bleeding on Probing readings for cemented bands from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Table 14. Average of Probing depths attributed to duration for cemented bands.

		Paired Samples Statistics			
		Mean	N	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

From previous table no. 14. 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 15. Source of difference for the average of Probing depths.

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 no. 15, 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.

6.3 HYPOTHESIS 2

“There is no statistically significant difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, probing depth, plaque, and bleeding on probing) for **bonded tubes**, with variations attributed to variables gender, Age and duration (T0, T3, and T6 months).”

6.3.1 Gingival parameters attributed to Gender for cemented bands.

Table 16. Gingival parameters attributed to gender for bonded tubes 1.

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Gingival Margin T0	Male	8	.0000	.00000 ^a	.00000
	Female	22	.0000	.00000 ^a	.00000
Plaque Index T0	Male	8	.0000	.00000 ^a	.00000
	Female	22	.0000	.00000 ^a	.00000
Gingival Index T0	Male	8	1.0000	.00000 ^a	.00000
	Female	22	1.0000	.00000 ^a	.00000
Bleeding on Probing T0	Male	8	2.0000	.00000 ^a	.00000
	Female	22	2.0000	.00000 ^a	.00000
Gingival Margin T3	Male	8	.0000	.00000	.00000
	Female	22	.0455	.21320	.04545
Plaque Index T3	Male	8	1.2500	.46291	.16366
	Female	22	1.1818	.85280	.18182
Gingival Index T3	Male	8	1.3750	.51755	.18298
	Female	22	1.6364	.49237	.10497
Bleeding on Probing T3	Male	8	1.6250	.51755	.18298
	Female	22	1.4545	.50965	.10866
Gingival Margin T6	Male	8	.0000	.00000	.00000
	Female	22	.0455	.21320	.04545
Plaque Index T6	Male	8	1.2500	.46291	.16366
	Female	22	1.2727	.63109	.13455
Gingival Index T6	Male	8	1.2500	.46291	.16366
	Female	22	1.5909	.50324	.10729
Bleeding on Probing T6	Male	8	1.7500	.46291	.16366
	Female	22	1.4091	.50324	.10729
ave_probingdepthT0	Male	8	1.3021	.29860	.10557
	Female	22	1.2917	.42316	.09022
ave_probingdepthT3	Male	8	1.4063	.36033	.12740
	Female	22	1.4583	.55679	.11871
ave_probingdepthT6	Male	8	1.4375	.31732	.11219
	Female	22	1.7311	.48790	.10402

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

Table 17. Gingival parameters attributed to gender for bonded tubes 2.

	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	1.568	.221	-.596	28	.556	-.04545	.07623	-.20160	.11069
			-1.000	21.000	.329	-.04545	.04545	-.13998	.04907
Plaque Index T3	2.999	.094	.213	28	.833	.06818	.31954	-.58637	.72273
			.279	23.174	.783	.06818	.24463	-.43766	.57403
Gingival Index T3	.012	.915	-1.269	28	.215	-.26136	.20593	-.68319	.16046
			-1.239	11.935	.239	-.26136	.21095	-.72127	.19854
Bleeding on Probing T3	.744	.396	.807	28	.426	.17045	.21123	-.26224	.60315
			.801	12.297	.438	.17045	.21281	-.29198	.63289
Gingival Margin T6	1.568	.221	-.596	28	.556	-.04545	.07623	-.20160	.11069
			-1.000	21.000	.329	-.04545	.04545	-.13998	.04907
Plaque Index T6	1.506	.230	-.093	28	.927	-.02273	.24504	-.52468	.47922
			-.107	17.062	.916	-.02273	.21187	-.46961	.42416
Gingival Index T6	3.509	.072	-1.673	28	.105	-.34091	.20373	-.75824	.07642
			-1.742	13.480	.104	-.34091	.19570	-.76216	.08034
Bleeding on Probing T6	3.509	.072	1.673	28	.105	.34091	.20373	-.07642	.75824
			1.742	13.480	.104	.34091	.19570	-.08034	.76216
ave_probingdept hT0	1.097	.304	.064	28	.950	.01042	.16338	-.32424	.34508
			.075	17.794	.941	.01042	.13887	-.28158	.30241
ave_probingdept hT3	1.069	.310	-.245	28	.808	-.05208	.21252	-.48742	.38325
			-.299	19.526	.768	-.05208	.17413	-.41588	.31171
ave_probingdept hT6	1.631	.212	-1.575	28	.126	-.29356	.18634	-.67527	.08814
			-1.919	19.424	.070	-.29356	.15299	-.61331	.02619

Through the previous table on 16 & 17, there is no significant differences between male and female regarding using bonded tubes on gingival parameters

6.3.2 Gingival parameters attributed to Age for bonded tubes.

Table 18. Gingival parameters attributed to gender for bonded tubes 1.

Group Statistics					
	Age in Interval	N	Mean	Std. Deviation	Std. Error Mean
Gingival Margin T0	Adolescent	11	.0000	.00000 ^a	.00000
	Adult	19	.0000	.00000 ^a	.00000
Plaque Index T0	Adolescent	11	.0000	.00000 ^a	.00000
	Adult	19	.0000	.00000 ^a	.00000
Gingival Index T0	Adolescent	11	1.0000	.00000 ^a	.00000
	Adult	19	1.0000	.00000 ^a	.00000
Bleeding on Probing T0	Adolescent	11	2.0000	.00000 ^a	.00000
	Adult	19	2.0000	.00000 ^a	.00000
Gingival Margin T3	Adolescent	11	.0909	.30151	.09091
	Adult	19	.0000	.00000	.00000
Plaque Index T3	Adolescent	11	1.0000	.63246	.19069
	Adult	19	1.3158	.82007	.18814
Gingival Index T3	Adolescent	11	1.5455	.52223	.15746
	Adult	19	1.5789	.50726	.11637
Bleeding on Probing T3	Adolescent	11	1.5455	.52223	.15746
	Adult	19	1.4737	.51299	.11769
Gingival Margin T6	Adolescent	11	.0000	.00000	.00000
	Adult	19	.0526	.22942	.05263
Plaque Index T6	Adolescent	11	1.2727	.64667	.19498
	Adult	19	1.2632	.56195	.12892
Gingival Index T6	Adolescent	11	1.5455	.52223	.15746
	Adult	19	1.4737	.51299	.11769
Bleeding on Probing T6	Adolescent	11	1.4545	.52223	.15746
	Adult	19	1.5263	.51299	.11769
ave_probingdepthT0	Adolescent	11	1.2576	.33220	.10016
	Adult	19	1.3158	.42544	.09760
ave_probingdepthT3	Adolescent	11	1.3561	.34978	.10546
	Adult	19	1.4956	.58100	.13329
ave_probingdepthT6	Adolescent	11	1.6364	.29878	.09008
	Adult	19	1.6623	.54325	.12463

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

Table 19. Gingival parameters attributed to gender for bonded tubes 2.

	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	8.757	.006	1.332	28	.194	.09091	.06827	-.04893	.23075
			1.000	10.000	.341	.09091	.09091	-.11165	.29347
Plaque indexT3	3.381	.077	-1.099	28	.281	-.31579	.28734	-.90437	.27279
			-1.179	25.513	.249	-.31579	.26788	-.86693	.23536
Gingival Index T3	.098	.756	-.172	28	.864	-.03349	.19423	-.43135	.36437
			-.171	20.509	.866	-.03349	.19580	-.44127	.37428
Bleeding on Probing T3	.041	.840	.367	28	.716	.07177	.19561	-.32892	.47247
			.365	20.704	.719	.07177	.19658	-.33740	.48094
Gingival Margin T6	2.558	.121	-.755	28	.456	-.05263	.06969	-.19538	.09012
			-1.000	18.000	.331	-.05263	.05263	-.16321	.05794
Plaque index T6	.295	.592	.043	28	.966	.00957	.22489	-.45111	.47025
			.041	18.672	.968	.00957	.23375	-.48025	.49939
Gingival Index T6	.041	.840	.367	28	.716	.07177	.19561	-.32892	.47247
			.365	20.704	.719	.07177	.19658	-.33740	.48094
Bleeding on Probing T6	.041	.840	-.367	28	.716	-.07177	.19561	-.47247	.32892
			-.365	20.704	.719	-.07177	.19658	-.48094	.33740
ave_probingdepthT0	.261	.614	-.389	28	.700	-.05821	.14953	-.36451	.24809
			-.416	25.323	.681	-.05821	.13985	-.34606	.22963
ave_probingdepthT3	2.576	.120	-.721	28	.477	-.13955	.19344	-.53581	.25670
			-.821	27.906	.419	-.13955	.16997	-.48777	.20866
ave_probingdepthT6	4.059	.054	-.145	28	.886	-.02592	.17835	-.39125	.33942
			-.169	27.976	.867	-.02592	.15378	-.34093	.28910

Through the previous tables 18 & 19, there is no significant differences between adolescent and adults regarding using bonded tubes on gingival parameters.

6.3.3 Gingival parameters attributed to Duration for bonded tubes

Gingival margin index: Repeated Measure ANOVA

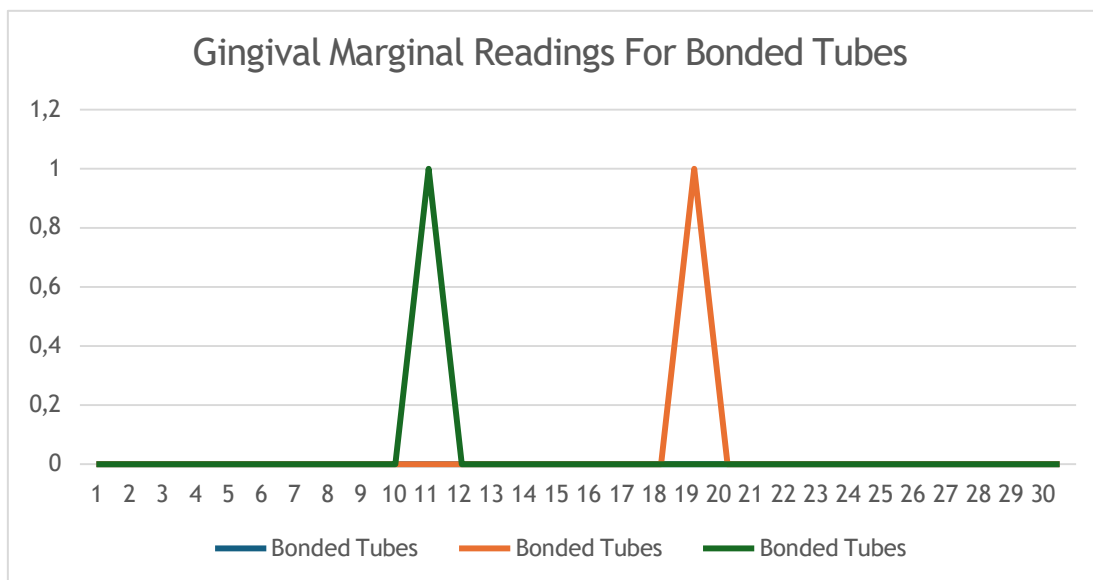


Figure 19: Descriptive statistics for Gingival marginal readings for bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Table 20. Gingival Margin attributed to Duration for bonded tubes 1.

		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 T0	.0000	30	.00000	.00000
	Gingival Margin T6	.0333	30	.18257	.03333
Pair 3	Gingival Margin T3	.0333	30	.18257	.03333
	Gingival Margin T6	.0333	30	.18257	.03333

Table 21. Gingival Margin attributed to Duration for bonded tubes 2.

		Paired Differences				t	df	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 2	Gingival Margin T0 - Gingival Margin T6	-.03333	.18257	.03333	-.10151	.03484	-1.000	29	.326
Pair 3	Gingival Margin T3 - Gingival Margin T6	.00000	.26261	.04795	-.09806	.09806	.000	29	1.000

From the previous tables 20 & 21 the significance level value ($P = 0.326 > 0.05$) indicates that there is no statistically significant difference in the level of Gingival margin according to the duration of bonded tubes using T0, T3, T6 months.

Plaque index: Repeated Measure ANOVA

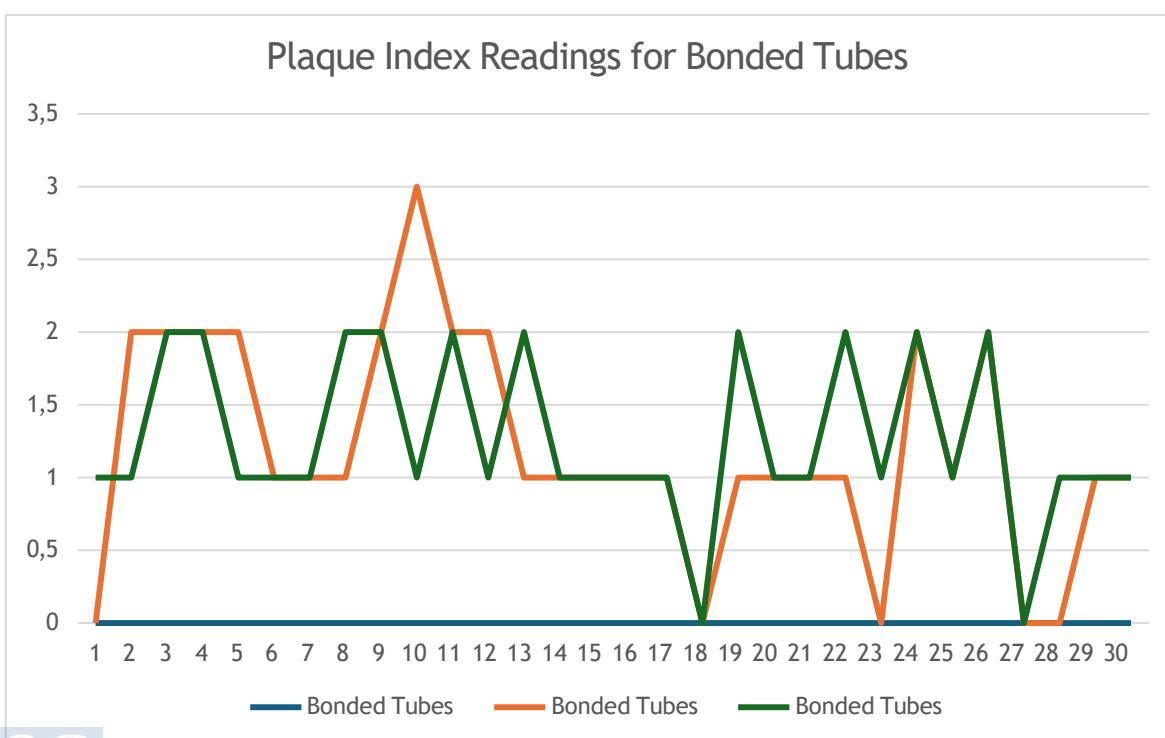


Figure 20: Descriptive statistics for Plaque Index readings for bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)



Table 22. Plaque index attributed to Duration for bonded tubes.

		Paired Samples Statistics			
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Plaque Index T0	.0000	30	.00000	.00000
	Plaque Index T3	1.2000	30	.76112	.13896
Pair 2	Plaque Index T0	.0000	30	.00000	.00000
	Plaque Index T6	1.2667	30	.58329	.10649
Pair 3	Plaque Index T3	1.2000	30	.76112	.13896
	Plaque Index T6	1.2667	30	.58329	.10649

From the previous table 22. The significance level value ($P = 0.000 < 0.05$) indicated that there is statistically significant difference in the level of Plaque index according to the duration of cemented bands using T0, T3, T6 months so, In order to identify the source of the differences, the compare means paired-samples T Test was used.

Table 23. Source of difference for Plaque index.

		Paired Differences					t	df	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	-1.20000	.76112	.13896	-1.48421	-.91579	-8.635	29	.000
Pair 2	Plaque Index T0 - Plaque Index T6	-1.26667	.58329	.10649	-1.48447	-1.04886	11.894	29	.000
Pair 3	Plaque Index T3 - Plaque Index T6	-.06667	.69149	.12625	-.32487	.19154	-.528	29	.601

From the previous table no. 23, there is statistically significant difference regarding plaque index between T0 – T3 and T6 for the bonded tubes. That’s mean the best stage where the plaque is less at level T0 and after that the plaque increased with time for 6 months study period.

Gingival index: Repeated Measure ANOVA

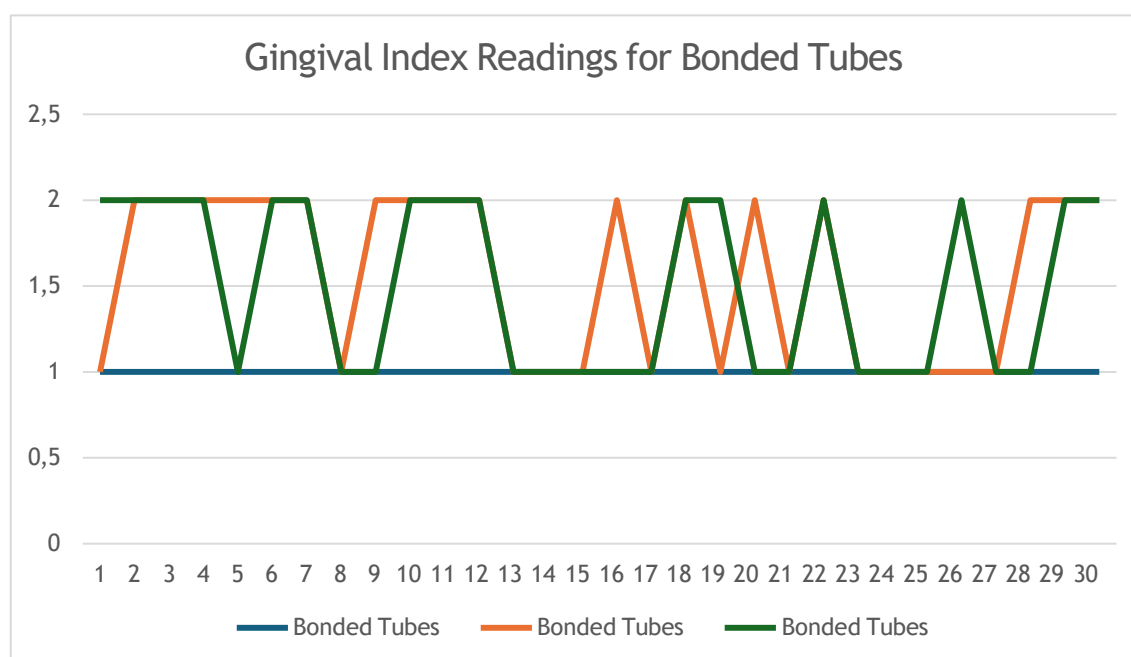


Figure 21: Descriptive statistics for Gingival Index readings bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Table 24. Gingival index attributed to Duration for bonded tubes.

		Paired Samples Statistics			
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Gingival Index T0	1.0000	30	.00000	.00000
	Gingival Index T3	1.5667	30	.50401	.09202
Pair 2	Gingival Index T0	1.0000	30	.00000	.00000
	Gingival Index T6	1.5000	30	.50855	.09285
Pair 3	Gingival Index T3	1.5667	30	.50401	.09202
	Gingival Index T6	1.5000	30	.50855	.09285

From previous table 24, the significance level value ($P = 0.000 < 0.05$) indicated that there is statistically significant difference in the level of Gingival index according to the duration of bonded tubes using T0, T3, T6 months so, In order to identify the source of the differences, the compare means paired-samples T Test was used.

Table 25. Source of difference for Gingival index.

		Paired Differences				t	df	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	-.56667	.50401	.09202	-.75487	-.37847	-6.158	29	.000
Pair 2	Gingival Index T0 - Gingival Index T6	-.50000	.50855	.09285	-.68989	-.31011	-5.385	29	.000
Pair 3	Gingival Index T3 - Gingival Index T6	.06667	.52083	.09509	-.12781	.26115	.701	29	.489

From the previous table no. 25, there is statistically significant difference regarding gingival index between T0 – T3 and between T0 and T6 for the bonded tubes. That’s means the best stage where the gingival index less at level T0 and after that the gingival index changed with time for around 6 months because in the middle 3 months between T3 – T6 there is no significant difference between the values. Therefore, the clear difference need around 6 months to be noticed.

Bleeding on probing: using Chi-square Test

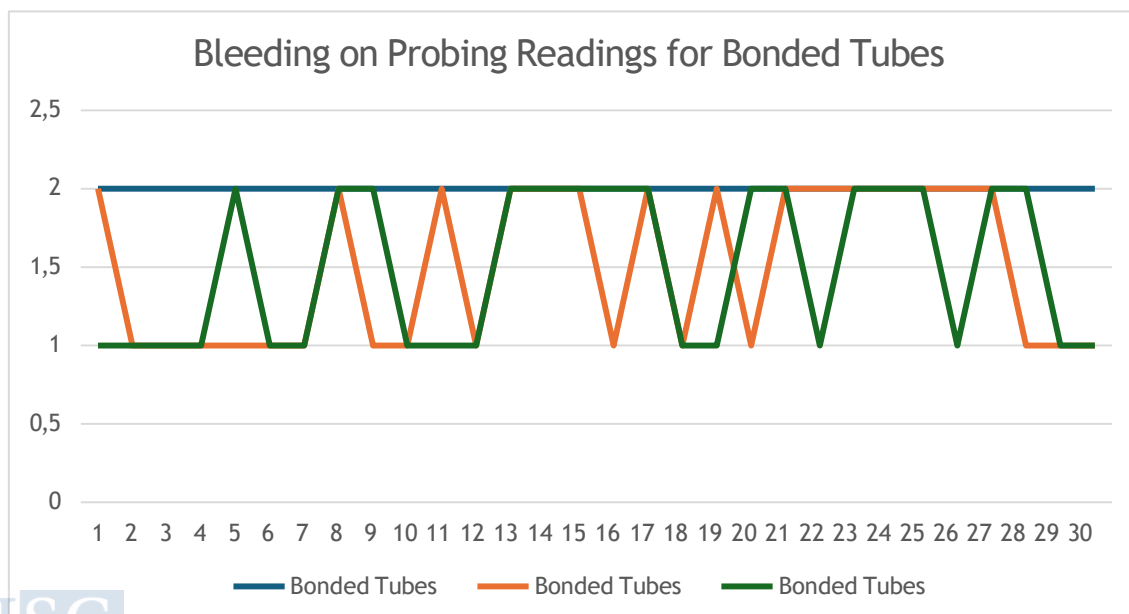


Figure 22: Descriptive statistics for Bleeding on Probing readings for bonded tubes from T0 - T6 as 1 means bleeding, 2 means no bleeding (Created by the Author: Mahmoud N. Almughany)

Table 26. Bleeding on Probing attributed to Duration for bonded tubes 1.

Bleeding on Probing Tube buccal T3 * Bleeding on Probing Tube buccal T6 Crosstabulation

			Bleeding on Probing Tube buccal T6		Total
			Y	N	
Bleeding on Probing Tube buccal T3	Y	Count	10	5	15
		% of Total	33.3%	16.7%	50.0%
	N	Count	5	10	15
		% of Total	16.7%	33.3%	50.0%
Total	Count	15	15	30	
	% of Total	50.0%	50.0%	100.0%	

Table 27 . Bleeding on Probing attributed to Duration for bonded tubes 2.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.333 ^a	1	.068		
Continuity Correction ^b	2.133	1	.144		
Likelihood Ratio	3.398	1	.065		
Fisher's Exact Test				.143	.072
Linear-by-Linear Association	3.222	1	.073		
N of Valid Cases	30				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.50.

b. Computed only for a 2x2 table

From previous tables 26 & 27, there is statistically significant difference regarding Bleeding on probing between T0, T3 and T6 for the bonded tubes, that's mean there is bleeding on probing changes for different stages of study duration.

Probing depth: 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.

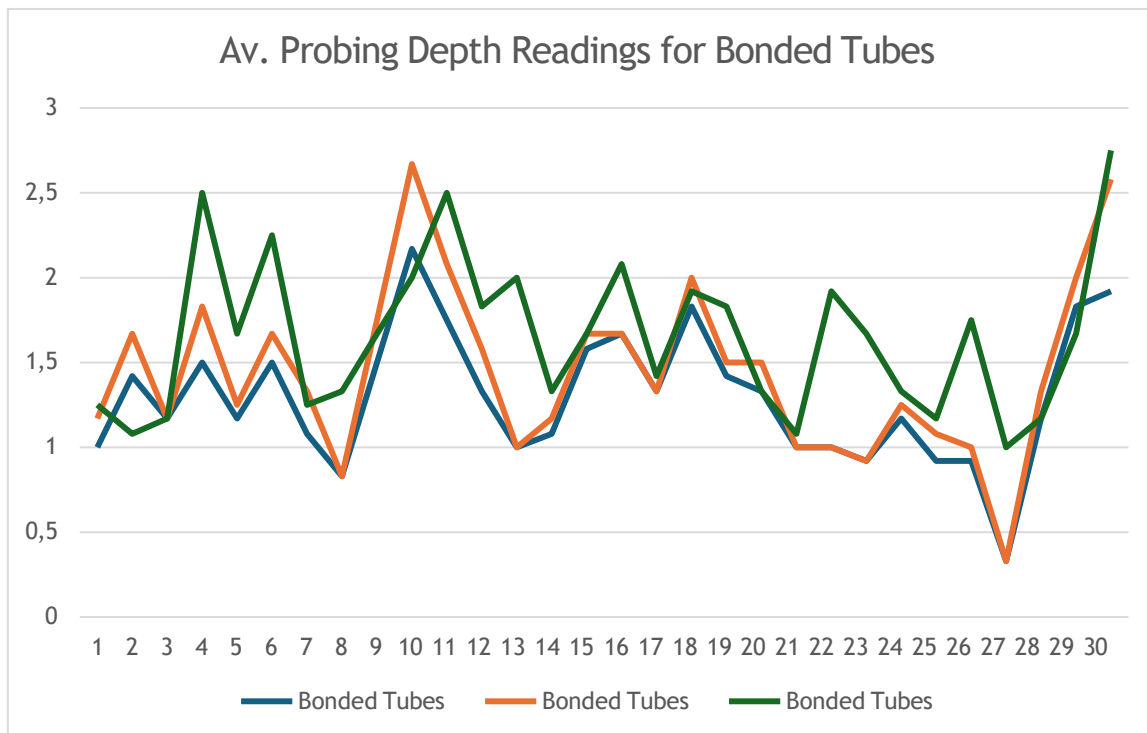


Figure 23: Descriptive statistics for Bleeding on Probing readings for bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Table 28. Probing depth(Mesiobuccally) attributed to Duration for bonded tubes.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	ave_probingdepthT0	1.2944	30	.38886	.07100
	ave_probingdepthT3	1.4444	30	.50635	.09245
Pair 2	ave_probingdepthT0	1.2944	30	.38886	.07100
	ave_probingdepthT6	1.6528	30	.46273	.08448
Pair 3	ave_probingdepthT3	1.4444	30	.50635	.09245
	ave_probingdepthT6	1.6528	30	.46273	.08448

From previous table no. 28, There is statistically significant difference regarding probing depth ($p= 0.000 < 0.05$) between T0-T3 -T6 for the bonded tubes. to know the differences compare means paired-samples T Test was used.

Table 29. Source of difference for Probing depth

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ave_probingdepthT0 - ave_probingdepthT3	-.15000	.15842	.02892	-.20915	-.09085	-5.186	29	.000
Pair 2	ave_probingdepthT0 - ave_probingdepthT6	-.35833	.37470	.06841	-.49825	-.21842	-5.238	29	.000
Pair 3	ave_probingdepthT3 - ave_probingdepthT6	-.20833	.41103	.07504	-.36181	-.05485	-2.776	29	.010

From previous table no. 29, there is statistically significant change in probing depth between beginning of the study between T0-T3 and T6 That mean the probing depth for the bonded tubes changed from the beginning of the treatment and increased with the duration increased. The mean change in the probing depth is 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.

6.4 HYPOTHESIS 3

“There is no statistically significant difference ($\alpha \leq 0.05$) in the level of gingival health parameters (gingival margin, gingival index, probing depth, plaque, and bleeding on probing) for **cemented bands and bonded tubes**, with variations attributed to duration (T0, T3, and T6 months).”

6.4.1 Comparing the right cemented band with left bonded tube for time (T0)

Tabel 30. Comparing the right cemented band with left bonded tube for time T0 (1)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Gingival Margin (Band)T0	.0000 ^a	30	.00000	.00000
	Gingival Margin (Tube) T0	.0000 ^a	30	.00000	.00000
Pair 2	Plaque Index (Band) T0	.0000 ^a	30	.00000	.00000
	Plaque (Tube) T0	.0000 ^a	30	.00000	.00000
Pair 3	Gingival Index (Band) T0	1.0000 ^a	30	.00000	.00000
	Gingival Index (Tube)T0	1.0000 ^a	30	.00000	.00000
Pair 4	Bleeding on Probing (Band) T0	2.0000 ^a	30	.00000	.00000
	Bleeding on Probing (Tube) T0	2.0000 ^a	30	.00000	.00000
Pair 5	Av. probing depthn (band) T0	1.2556	30	.44953	.08207
	Av. Probing depth (Tube) T0	1.2944	30	.38886	.07100

a. The correlation and t cannot be computed because the standard error of the difference is 0.

Tabel 31. Comparing the right cemented band with left bonded tube for time T0 (2)

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 5	Av. Probing depth (Band) T0 - Av. Probing depth (Tube) T0	-.03889	.38639	.07054	-.18317	.10539	-.551	29	.586

From the above table we conclude that there is no statistical difference between cemented bands and bonded tubes for gingival parameters among T0 because P. value>0.05

6.4.2 Comparing the right cemented band with left bonded tube for time (T3)

Tabel 32. Comparing the right cemented band with left bonded tube for time T3 (1)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Gingival Margin (Band) T3	.0333 ^a	30	.18257	.03333
	Gingival Margin (Tube) T3	.0333 ^a	30	.18257	.03333
Pair 2	Plaque Index (Band) T3	.8333	30	.87428	.15962
	Plaque Index (Tube) T3	1.2000	30	.76112	.13896
Pair 3	Gingival Index (Band) T3	1.5000	30	.50855	.09285
	Gingival Index (Tube) T3	1.5667	30	.50401	.09202
Pair 4	Bleeding on Probing (Band) T3	1.5000	30	.50855	.09285
	Bleeding on Probing (Tube) T3	1.5000	30	.50855	.09285
Pair 5	Av. Probing depth (Band) T3	1.4861	30	.55237	.10085
	Av. Probing depth (Tube) T3	1.4444	30	.50635	.09245

a. The correlation and t cannot be computed because the standard error of the difference is 0.

Tabel 33. Comparing the right cemented band with left bonded tube for time T3 (2)

		Paired Differences				t	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 2	Plaque Index (Band) T3 - Plaque Index (Tube)T3	-.36667	.49013	.08949	-.54969	-.18365	-4.097	29	.000
Pair 3	Gingival Index (Band) T3 - Gingival Index (Tube) T3	-.06667	.52083	.09509	-.26115	.12781	-.701	29	.489
Pair 4	Bleeding on Probing (Band) T3 - Bleeding on Probing (Tube) T3	.00000	.45486	.08305	-.16985	.16985	.000	29	1.000
Pair 5	Av. Probing depth (Band) T3 - Av. Probing depth (Tube) T3	.04167	.45735	.08350	-.12911	.21244	.499	29	.622

From the above table we conclude that there is no statistical difference between cemented bands and bonded tubes for gingival parameters among T3 because P. value > 0.05

6.4.3 Comparing the right cemented band with left bonded tube for time (T6)

Tabel 34. Comparing the right cemented band with left bonded tube for time T6 (1)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Gingival Margin (Band) T6	.0333	30	.18257	.03333
	Gingival Margin (Tube) T6	.0333	30	.18257	.03333
Pair 2	Plaque Index (Band)T6	1.1667	30	.74664	.13632
	Plaque Index (Tube) T6	1.2667	30	.58329	.10649
Pair 3	Gingival Index (Band) T6	1.5667	30	.50401	.09202
	Gingival Index (Tube) T6	1.5000	30	.50855	.09285
Pair 4	Bleeding on Probing (Band) T6	1.4333	30	.50401	.09202
	Bleeding on Probing (Tube)T6	1.5000	30	.50855	.09285
Pair 5	Av. Probing depth (Band) T6	1.8306	30	.44231	.08075
	Av. Probing depth (Tube) T6	1.6528	30	.46273	.08448

Table 35. Comparing the right cemented band with left bonded tube for time T6 (2)

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 Gingival Margin (Band) T6 - Gingival Margin (Tube) T6	.00000	.26261	.04795	-.09806	.09806	.000	29	1.000
Pair 2 Plaque Index (Band)T6 - Plaque Index (Tube) T6	-.10000	.60743	.11090	-.32682	.12682	-.902	29	.375
Pair 3 Gingival Index (Band) T6 - Gingival Index (Tube) T6	.06667	.52083	.09509	-.12781	.26115	.701	29	.489
Pair 4 Bleeding on Probing (Band)T6 - Bleeding on Probing (Tube) T6	-.06667	.52083	.09509	-.26115	.12781	-.701	29	.489
Pair 5 Av. Probing depth (Band) T6 - Av. Probing depth (Tube) T6	.17778	.43037	.07857	.01708	.33848	2.263	29	.031

From the above table we conclude that there is no statistical difference between cemented bands and bonded tubes for gingival parameters among T6 because P. value>0.05

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

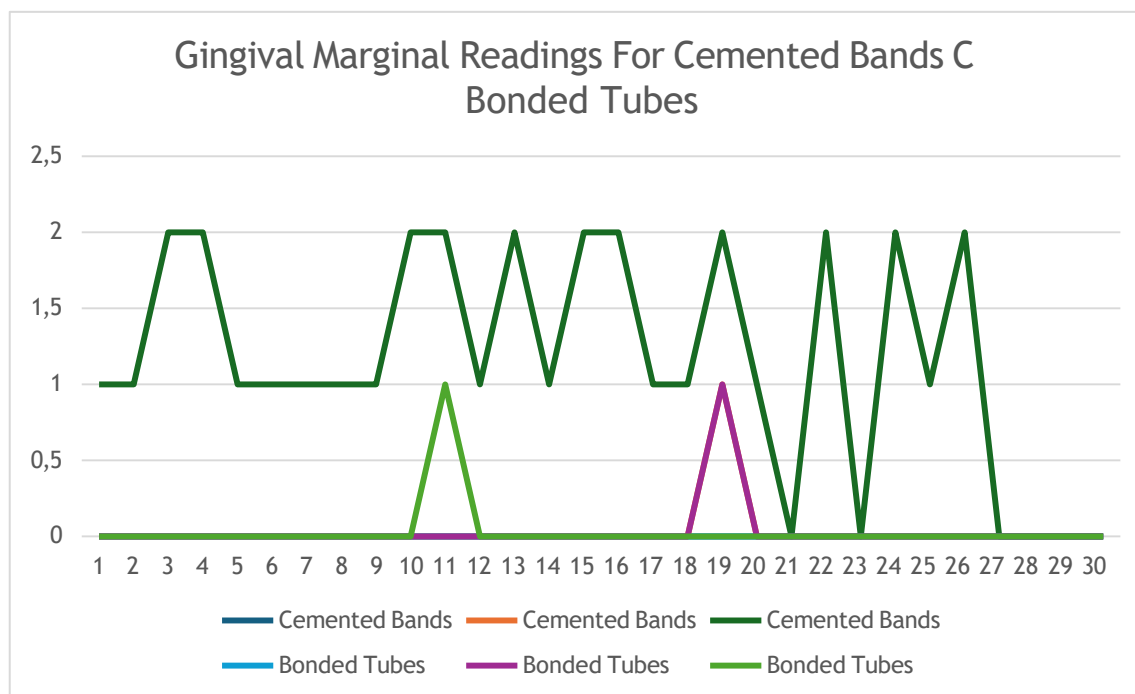


Figure 24: Descriptive statistics for Gingival marginal readings for cemented bands and bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Tabel 36. 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 37. 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 statistical difference between cemented bands and bonded tubes for gingival margin among three time because P. value=1.0

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

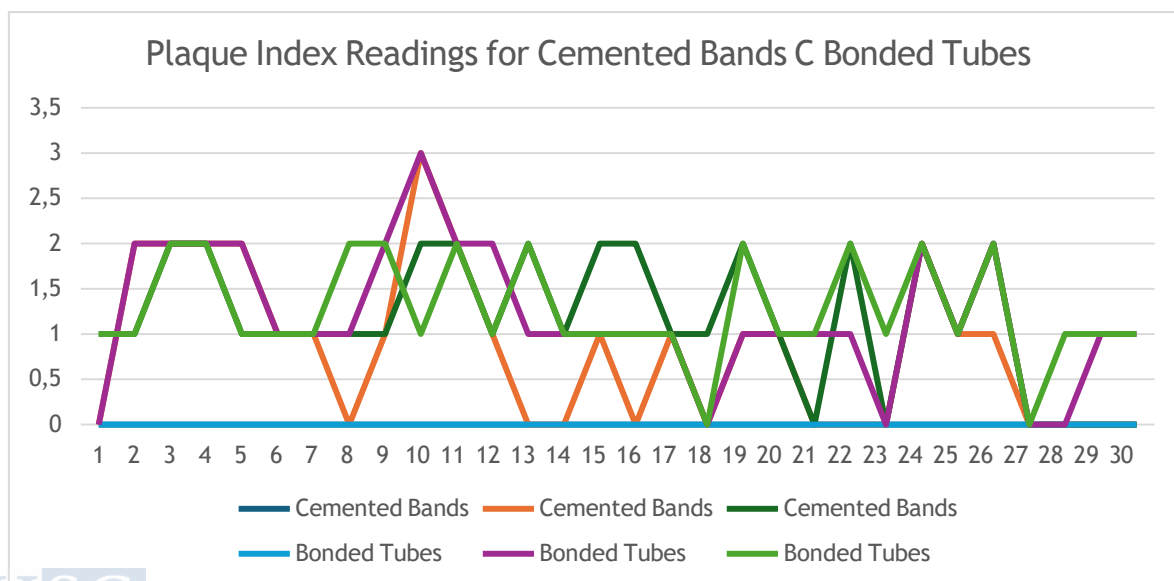


Figure 25: Descriptive statistics for Plaque Index readings for cemented bands and bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Tabel 38. 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.

Tabel 39. 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 statistical difference between cemented bands and bonded tubes for Plaque index among three time because P. value=0.2

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

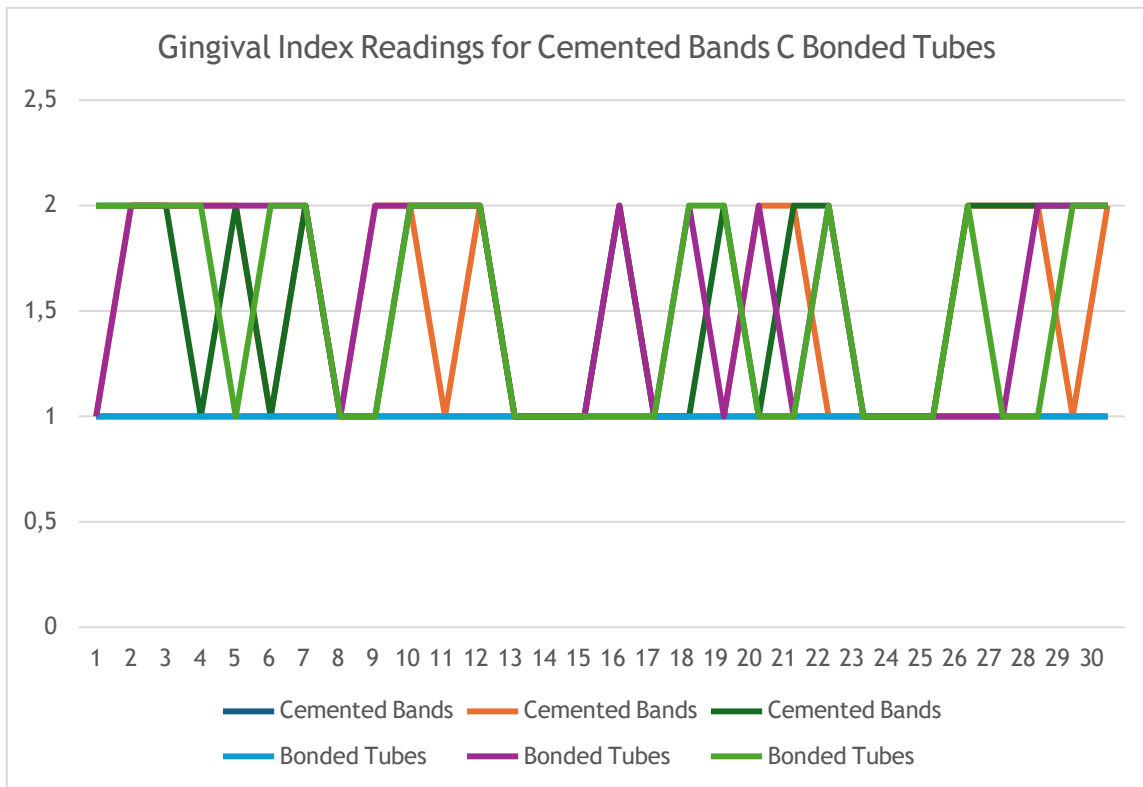


Figure 26: Descriptive statistics for Gingival Index readings for cemented bands and bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)

Tabel 40. 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.

Tabel 41. 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

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

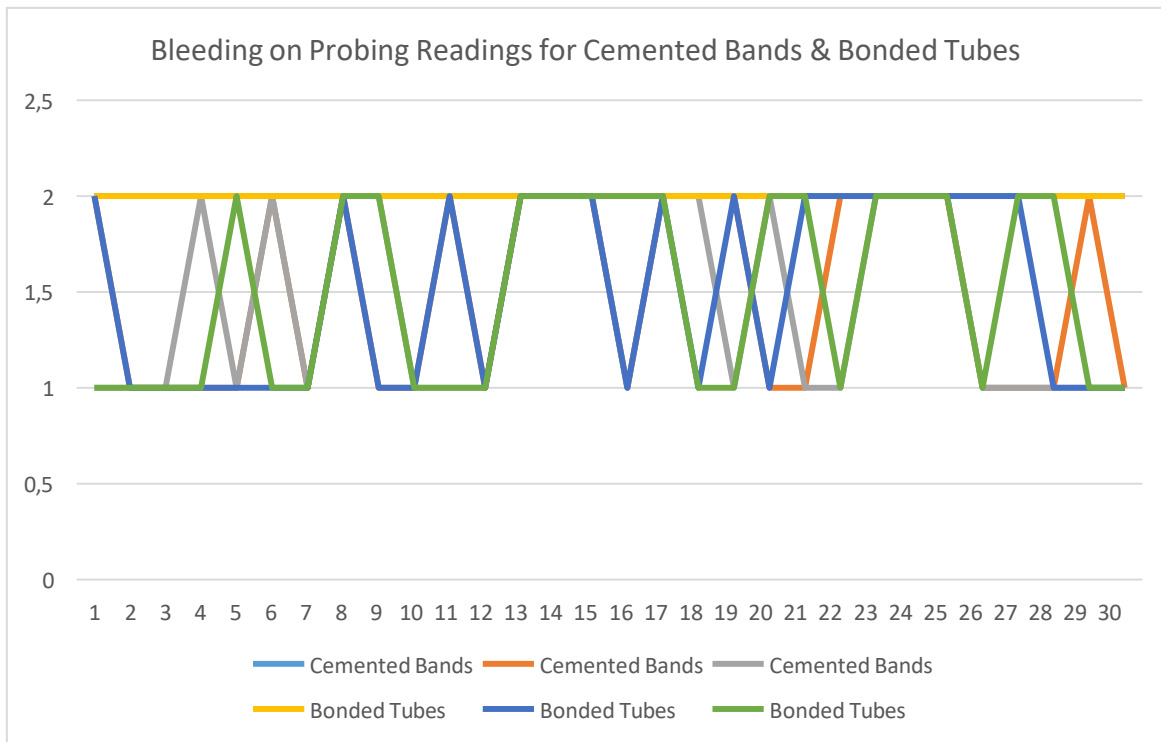


Figure 27: Descriptive statistics for Bleeding on Probing readings for cemented bands and bonded tubes from T0 - T6 as 1 means bleeding, 2 means no bleeding (Created by the Author: Mahmoud N. Almughany)

Tabel 42. 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%

Tabel 43. 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

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

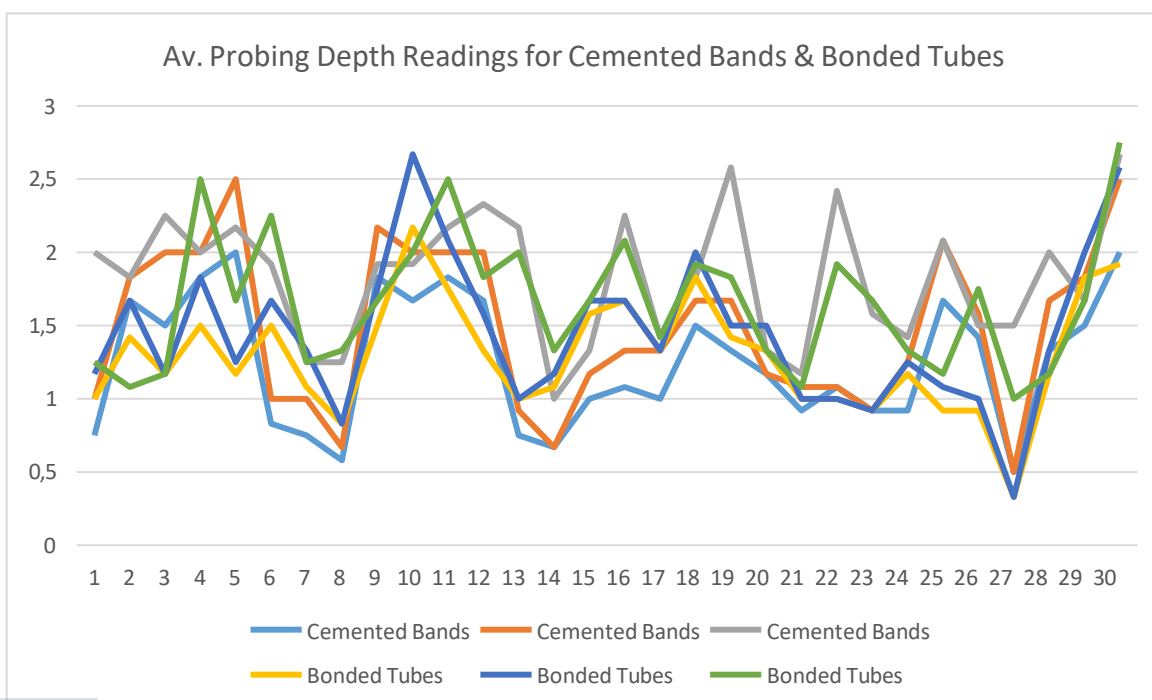


Figure 28: Descriptive statistics for Bleeding on Probing readings for cemented bands and bonded tubes from T0 - T6 (Created by the Author: Mahmoud N. Almughany)



Tabel 44. 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

Tabel 45. 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 MB among three time because P. value=1.0.

7

Discussion

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7 DISCUSSION

The study has investigated the effect of using molar bands and bonded tubes on gingival health parameters and comparing between them during fixed orthodontic treatment with the effect of socio-economic factors and treatment duration. These periodontal parameters are gingival margin, gingival index, plaque index and bleeding on probing and probing depth.

The study investigates that if there are significant differences when using bands or bonded tubes on the gingival health parameters especially with treatment duration while with the socio-economic factors as gender and age have no significant differences.

In addition to that there is no significant differences between the effect of cemented bands and bonded tubes on gingival parameters when comparing to each other in relation to duration variable, both have changes not significant to each other.

This is mismatching with a study published in august 2012 to evaluate the periodontal condition during fixed orthodontic treatment, their findings were adolescent present a higher plaque index and the accumulation of plaque is more severe with bands while in this research age factor have no relation to the changes occurred, this may be due to instructions and visits follow up about oral hygiene maintenance, teeth brushing , dietary habits and patients cooperations.(83)

Another research findings indicated that, using cemented bands alone or bonded tubes alone have significant changes on gingival health parameters while using fixed orthodontic appliance from the beginning of the treatment until six months according to research criteria.

And this is matching with a study done in 2023 by Mashal Amir et al., for the effect of orthodontic banding on gingival health of first molar teeth. The findings showed that orthodontic banding can adversely affect the gingival health in patients receiving fixed appliance treatment, lack of poor oral hygiene maintenance further aggravates poor gingival health.(17)

Also, there is matching with another study done in October 2016, survival analysis study done by Oeiras et al.,of banding and bonding molar tubes in adult patients over a 12-month period: a split-mouth randomized clinical trial study, they found that bonding of

orthodontic tubes to molars is like molar banding. And this is the same as research results, banding and bonding both adversely affecting gingival health and no difference between there effect.(22)

When comparing the effect of molar bands and bonded tubes. The results show that there is no statistically significant difference between them. This is matching with a previous 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.(13)

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 agreed with the research results.(19)

Other study done in November 2015, by Al-Anezi, 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 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 2017, Sameena published an article titled molar bands vs bonds: does bonding cements have a role in microbial colonization, one of the findings was molar bonding may be a better option against molar banding to reduce the risk of caries and gingival diseases around the orthodontic appliance.

These findings mismatching with the research results as research results showed no significant change on gingival health between using molar bands and bonded tubes, but there is a truth that using bonds reduce the risk of caries as the tube cover a small part of the tooth and does not encircle the tooth like band.(18)

Whether to band or bond molar during fixed orthodontic treatment is an old-new dilemma


In 1992 before thirty-two years, Robert I. Boyd et al. spoke about this in research titled as periodontal considerations in the use of bands or bonded maxillary molars in adolescent and adults.(7) The summary of their findings were more plaque accumulation, gingival inflammation and interproximal loss of attachments were observed for banded maxillary molars than bonded maxillary molars and a higher mean value for plaque accumulation and gingival inflammation were seen for adolescent than for adults during and after orthodontic treatment. This is mismatching with research results that are no differences between banding or bonding, this mismatching may be due to that this research done with three readings (pretreatment, after three and six months) while Boyd study done for longer period around 18 months (pretreatment, during and post treatment) this longer period may affect the findings and give an indication if the recent research increase the duration the results may change. Another point, Boyd results indicated that adolescent have more plaque accumulation and gingival inflammation and this is opposite to this research results as there is no significant difference between them and this may be due to oral hygiene knowledge become more common in young and old ages also patient education for oral hygiene maintenance become more easier nowadays and patients give more attention to their teeth and to procedures to save them healthy.

In March 2020 a study done by Talab Alqarari, to evaluate the periodontal health changes and measurement of interleukin-1 and interleukin-6 in gingival crevicular fluid after orthodontic band and bond during orthodontic treatment.(84)

The findings were placement of molar bands could be more damaging to periodontal health than the use of buccal tubes and this is mismatching with the research results. This mismatching may be due to that, this research done as control and experimental groups for a total 84 molars and the interleukin 1 and 6 determination done before, after six and twelve months of experiment.

A study done on September 2020 by Lishoy Rodrigues titled as molar banding or bonding? What do orthodontists prefer in routine clinical practice? The finding was orthodontists prefer using bondable molar tubes over molar banding in their routine clinical practice, these results are matching with research results.(10) By concentration on the results tables, small difference in values will be found between bands and bonds regarding gingival health parameters, but these differences are not significant to each other. Because of this we can recommend orthodontists to use molar bonds for its advantages over bands as it is save a lot of clinical time, more comfortable to patients, no need to use separators like bands, bonding procedure done in one visit and caries detection become more easier.

In 2003, Afrah Al Hamdany published an article about changes in gingiva with orthodontically banded and bonded teeth.(23)

 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 Afrah's 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 their 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, and this may be affected by brushing and oral hygiene between them. But this research the area for bands and bonds is the posterior area and all the environmental factors are the same.

In 2022, Kiani et al. conducted a study titled Comparison of the Periodontal Probing Status between Molar Bands and Bonded Molar Tubes in Orthodontic Patients. (85)

The findings were significantly greater periodontal probing depths in molars fitted with bands compared to those fitted with bonded molar tubes. Their findings demonstrated that banded molars exhibited statistically higher post-treatment probing depth values.

Their study, which followed patients over a 6-month period similar to the duration of the present research, produced results consistent with ours in showing that both molar bands and bonded tubes influence gingival parameters particularly probing depth. However, unlike Kiani et al., the present study did not observe as pronounced an increase in post-treatment probing depth for banded molars. This discrepancy may be attributed to the regular follow-up appointments and continuous oral hygiene reinforcement provided to our participants, which likely contributed to improved periodontal outcomes.

In 2024, Maham Niazi and colleagues published A Comparative Study of Gingival Health of Orthodontic Patients with Bands and Buccal Tubes on First Molars. (86)

Their findings indicated an increase in the Gingival Index for both the banded and bonded groups, with notable plaque accumulation observed particularly around molar bands after six months of treatment. These results align closely with those of the present study, which also demonstrated that both molar bands and bonded tubes can affect gingival health.

Niazi et al. further reported that plaque accumulation became more pronounced after six months; since the current study's follow-up period concluded at six months, future research with extended monitoring is recommended to determine whether similar trends emerge beyond this timeframe.

When reviewing the literature relevant to this study, it became apparent that there is a scarcity of research addressing orthodontic or periodontal conditions within Arab populations.

Al-Harhi (2013) highlighted this gap in her review of periodontal disease among adults in the Arab world. (3)

Concluding that up-to-date epidemiological data on periodontitis in the region are limited, with most available studies being over a decade old. She emphasized the need for contemporary, population-representative data to support guideline development, resource allocation, and public health planning. In this context, the current research aims to contribute meaningful data to the limited body of literature addressing the relationship between orthodontics and periodontics in the Arab region.

Similarly, Elshanti et al. (2020) conducted a cross-sectional study on the prevalence and severity of gingivitis among high school students in the Gaza Strip. (15)

They noted the limited epidemiological information available for the region and found that gingivitis prevalence was highest among students in North Gaza and Gaza City. The authors suggested that further research is required to explore the underlying causes of these regional differences.

Their study also demonstrated that low paternal educational level was significantly associated with higher risk of gingivitis, underscoring the influence of socioeconomic and educational factors on oral health.

These findings, together with the results of the present study, highlight the importance of strengthening oral hygiene education for both patients and their parents

8

Conclusion

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8 CONCLUSION

- Even in short term of insertion of fixed orthodontic appliance induced changes of gingival health occurred when using molar bands or bonded tubes.
- Fixed orthodontic appliances increase the plaque accumulation due to its auxiliaries and accessories and this may affect the gingival health parameters.
- The gender of patient receiving fixed orthodontic appliance treatment have no relevant effect of the changes that may occur on the gingival health.
- The Age groups of patients receiving fixed orthodontic appliance treatment have no relevant effect of the changes that may occur on the gingival health.
- 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.

9

Recommendations

9 RECOMMENDATIONS

- For orthodontists:
 - 1- Before active orthodontic treatment, Orthodontist should carefully evaluate the patient's oral hygiene status and if the patient diagnosed that he has bad oral hygiene, it's preferable to make education and instructions before appliance bonding.
 - 2- 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.
 - 3- Regular gingival evaluations should be integrated into orthodontic follow-up visits, especially for patients with pre-existing gingival conditions and interval scaling if needed.
 - 4- Its advisable to cement the molar band slight subgingivally and no do deep in gingiva this promotes good cleansable area and decrease plaque accumulation.
 - 5- Using molar bands and bonded tubes in short rang, there is no difference between their effect on gingival health.
 - 6- It's advisable to use bonded tubes for treatment according to their advantages unless the case indicated for banding.
 - 7- Our recommendations for the researchers to study the effect of bands and bonds on more long period.
 - 8- It is critical for orthodontists to take into consideration the patients' susceptibility to suffer periodontal disease, taking the necessary measures during the orthodontic treatment to minimize dental plaque retention.

- For patients:
 - 1- Patients must take more concern to oral hygiene and brush their teeth after meals, using interdental floss and mouth washes.
 - 2- Patient must follow oral hygiene instructions that advice by orthodontist to maintain healthy gingiva during active orthodontic treatment.
 - 3- During active orthodontic treatment, patients should communicate with orthodontist if they noticed changes related to their gingiva as swellings or pain etc.

10

Strengths and limitations of this study

10 STRENGTHS AND LIMITATIONS OF THIS STUDY

- **Strengths:**

The research presents a numerous strength. Firstly, the analysis of gingival health parameters (gingival margin, gingival index, plaque index, bleeding on probing and probing depth) was performed with different time intervals from pretreatment, during and till 6 months.

Secondly, 30 patient's oral hygiene and gingival parameters was checked and examined each regular visit, and positive reinforcement and education for participants to maintain oral healthy gingiva and teeth and motivate them to reach that.

- **Limitations:**

The research has a few limitations. Firstly, the relatively short duration of this study (six months) restricts the ability to have conclusions about the long-term effects of fixed orthodontic treatments on an individual's periodontal health.

Secondly the inability to use the electronic digital periodontal probe as it does not find in my country and cannot afford it from outside due to it's high expensive price.

11

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12

Annexes

12 ANNEXES

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12.2 ANNEX 2. DATA COLLECTION FIRST STAGE

Data Collection First stage in May 2024															
No.	Age	Upper right first molar (Banded)						Upper right first molar (Banded)							
		ingival margi	Plaque	G.I	ding on pro	Probing depth			ingival margi	Plaque	G.I	ding on pro	Probing depth		
		buccal	buccal	buccal	MB	B	DB	buccal	buccal	buccal	MB	B	DB		
1	17	0	0	1	2	1	0	1	0	0	1	2	1	1.5	1
2	18	0	0	1	2	1	2	2	0	0	1	2	1.5	1	1.5
3	18	0	0	1	2	2	1	2	0	0	1	2	2	1	1
4	19	0	0	1	2	2	2	3	0	0	1	2	2	2	2
5	13	0	0	1	2	2	2	2	0	0	1	2	1.5	1	2
6	18	0	0	1	2	1	0.5	1	0	0	1	2	2	2	2
7	15	0	0	1	2	1	1	1	0	0	1	2	1.5	1	2
8	17	0	0	1	2	0.5	0.5	0.5	0	0	1	2	0.5	1	1.5
9	19	0	0	1	2	2	1	2	0	0	1	2	1.5	1	2
10	20	0	0	1	2	2	2	2	0	0	1	2	2	2	1
11	18	0	0	1	2	2	2	2	0	0	1	2	2	1.5	1
12	20	0	0	1	2	2	2	1	0	0	1	2	2	1	2
13	26	0	0	1	2	0.5	0.5	1.5	0	0	1	2	1	1	2
14	18	0	0	1	2	0.5	0.5	0.5	0	0	1	2	2	0.5	1
15	15	0	0	1	2	1	2	1	0	0	1	2	1.5	1	2
16	15	0	0	1	2	2	1.5	1	0	0	1	2	2.5	2	1
17	18	0	0	1	2	1	1	1	0	0	1	2	1	0.5	2
18	14	0	0	1	2	1.5	2	2	0	0	1	2	3	2	2
19	14	0	0	1	2	2	2	1	0	0	1	2	3	2	1
20	17	0	0	1	2	1	2	1	0	0	1	2	2	1	2
21	19	0	0	1	2	1	0.5	1	0	0	1	2	1.5	0.5	1
22	17	0	0	1	2	2	0.5	1	0	0	1	2	1	1.5	0.5
23	18	0	0	1	2	2	0.5	1	0	0	1	2	2	1	1
24	22	0	0	1	2	1	1	1	0	0	1	2	2	1	1.5
25	26	0	0	1	2	2	1	1	0	0	1	2	1	0.5	2
26	17	0	0	1	2	2	2	2	0	0	1	2	1	1	1
27	31	0	0	1	2	1	0	1	0	0	1	2	0	0	1
28	35	0	0	1	2	0	0	2	0	0	1	2	2	1	2
29	27	0	0	1	2	2	1	2	0	0	1	2	2	1	2
30	21	0	0	1	2	2	2	2	0	0	1	2	2	2	2

12.3 ANNEX 3. DATA COLLECTION SECOND STAGE

ata Collection Second stage in August 2024															
No.	Age	Upper right first molar (Banded)							Upper right first molar (Bonded)						
		ingival margi	Plaque	G.I	ding on pro	Probing depth			Ingival margi	Plaque	G.I	ding on pro	Probing depth		
		buccal	buccal	buccal	MB	B	DB	buccal	buccal	buccal	MB	B	DB		
1	17	0	0	1	2	1.5	0	1	0	0	1	2	1	2	1
2	18	0	2	2	1	1	2	3	0	2	2	1	2	1	2
3	18	0	2	2	1	3	1	3	0	2	2	1	2	1	1
4	19	0	2	2	1	3	2	3	0	2	2	1	3	2	3
5	13	0	2	2	1	3	2	3	0	2	2	1	2	1	2
6	18	0	1	1	2	1	1	1	0	1	2	1	3	2	2
7	15	0	1	2	1	2	1	1	0	1	2	1	2	1	3
8	17	0	0	1	2	0.5	0.5	1	0	1	1	2	0.5	1	1.5
9	19	0	1	2	1	3	1	2	0	2	2	1	2	1.5	2.5
10	20	0	3	2	1	3	3	2	0	3	2	1	2	2	1
11	18	0	2	1	2	3	2	2	0	2	2	2	2.5	2	1
12	20	0	1	2	1	3	2	1	0	2	2	1	2.5	2	2
13	26	0	0	1	2	1	1	1.5	0	1	1	2	1	1	2
14	18	0	0	1	2	0.5	0.5	0.5	0	1	1	2	2.5	0.5	1
15	15	0	1	1	2	2	2	1	0	1	1	2	2	1	2
16	15	0	0	2	1	2	2	2	0	1	2	1	2.5	2	1
17	18	0	1	1	2	1	1	2	0	1	1	2	1	0.5	2
18	14	0	0	1	2	2.5	2	2	0	0	2	1	3	2	3
19	14	1	1	1	2	3	2	2	1	1	1	2	3	2	1
20	17	0	1	2	1	1	2	1	0	1	2	1	2.5	1.5	2
21	19	0	0	2	1	1	1	1.5	0	1	1	2	1.5	0.5	1
22	17	0	0	1	2	2	0.5	1	0	1	2	2	1	1.5	0.5
23	18	0	0	1	2	2	0.5	1	0	0	1	2	2	1	1
24	22	0	2	1	2	2	2	1	0	2	1	2	2	1.5	1.5
25	26	0	1	1	2	2	1	1.5	0	1	1	2	1	0.5	3
26	17	0	1	2	1	2	2	3	0	2	1	2	1.5	1	1
27	31	0	0	2	1	1	0	1	0	0	1	2	0	0	1
28	35	0	0	2	1	0	0	3	0	0	2	1	2	1	3
29	27	0	0	1	2	3	1	3	0	1	2	1	2	1	2
30	21	0	0	2	1	3	2	3	0	1	2	1	2	3	3

12.4 ANNEX 4. DATA COLLECTION THIRD STAGE

Data Collection Third stage in November 2024															
No.	Age	Upper right first molar (Banded)							Upper right first molar (Bonded)						
		ingival margi	Plaque	G.I	Ding on pro	Probing depth			ingival margi	Plaque	G.I	Ding on pro	Probing depth		
		buccal	buccal	buccal	buccal	MB	B	DB	buccal	buccal	buccal	buccal	MB	B	DB
1	17	0	1	2	1	3	3	2	0	1	2	1	2	2	1
2	18	0	1	2	1	2	2	3	0	1	2	1	2	1	1
3	18	0	2	2	1	3	1.5	3	0	2	2	1	2	1	1
4	19	0	2	1	2	2	1	3	0	2	2	1	3	3	3
5	13	0	1	2	1	3	1	4	0	1	1	2	2	1	3
6	18	0	1	1	2	1	1	2	0	1	2	1	3.5	2	3
7	15	0	1	2	1	2	2	1	0	1	2	1	2	1	2
8	17	0	1	1	2	1	1	2	0	2	1	2	2	0.5	1.5
9	19	0	1	1	2	2	2	3	0	2	1	2	2	2	3
10	20	0	2	2	1	3	2	2.5	0	1	2	1	3	1	1
11	18	0	2	2	1	3	4	2	1	2	2	1	4	2	2
12	20	0	1	2	1	3	2	2	0	1	2	1	2	2	3
13	26	0	2	1	2	2	1	3	0	2	1	2	2	2	3
14	18	0	1	1	2	2	1	1	0	1	1	2	1	1	2
15	15	0	2	1	2	2.5	2	1	0	1	1	2	2.5	1	1.5
16	15	0	2	2	1	3	2	3	0	1	1	2	3	2	2
17	18	0	1	1	2	1	1.5	2	0	1	1	2	1	0.5	2
18	14	0	1	1	2	3	2	2	0	0	2	1	3	2.5	3
19	14	1	2	2	1	5	2	3	0	2	2	1	3	2	2
20	17	0	1	1	2	2	1	1.5	0	1	1	2	1.5	1	2
21	19	0	0	2	1	1.5	1	1.5	0	1	1	2	1.5	0.5	1
22	17	0	2	2	1	3	2.5	2	0	2	2	1	2	2	2.5
23	18	0	0	1	2	2	1	2	0	1	1	2	3	2	1
24	22	0	2	1	2	2	2.5	1	0	2	1	2	2	1.5	1.5
25	26	0	1	1	2	2.5	1	1.5	0	1	1	2	1.5	0.5	3
26	17	0	2	2	1	2	1	2	0	2	2	1	3	1	3
27	31	0	0	2	1	2	3	1	0	0	1	2	1	1	1
28	35	0	0	2	1	2	3	3	0	1	1	2	1	1	1
29	27	0	0	2	1	2	1	3	0	1	2	1	1	1	2
30	21	0	0	2	1	3.5	2	3	0	1	2	1	2.5	3	3

12.5 ANNEX 5. HELSINKI COMMITTEE FOR ETHICAL APPROVAL



المجلس الفلسطيني للبحوث الصحية Palestinian Health Research Council

تعزيز النظم الصحي الفلسطيني من خلال مأسسة استخدام المعلومات البحثية في صنع القرار

"Developing the Palestinian health system through institutionalizing the use of information in decision making"

Helsinki Committee For Ethical Approval

Date: 2024/03/01

Number: PHRC/HC/1169/24

Name: Mahmoud N. Almughany

الاسم:

We would like to inform you that the committee had discussed the proposal of your study about:

نفيدكم علماً بأن اللجنة قد ناقشت مقترح دراستكم
حول:

Comparing the changes of periodontal parameters between banded and bonded teeth during fixed orthodontic treatment

The committee has decided to approve the above mentioned research. Approval number PHRC/HC/1169/24 in its meeting on 2024/03/01

و قد قررت الموافقة على البحث المذكور عاليه
بالرقم والتاريخ المذكوران عاليه

Member
2024
12/13

Signature

8/12/2024

Chairman

Member



Dr. Yehia Abo

General Conditions:-

1. Valid for 2 years from the date of approval.
2. It is necessary to notify the committee of any change in the approved study protocol.
3. The committee appreciates receiving a copy of your final research when completed.


Specific Conditions:-

E-Mail: pal.phrc@gmail.com


Gaza - Palestine

غزة - فلسطين

12.6 ANNEX 6. PERIODONTAL CHART EXAMINATION FOR PHD RESEARCH REQUIREMENT



USC
UNIVERSIDADE
DE SANTIAGO
DE COMPOSTELA





Siwak
سواك لعلي الأسنان
siwak dental clinic

Periodontal Chart Examination for PhD research Requirement

Researcher: Mahmoud N. Almughany

Participants Name: , **Sex:** M, F, **Age:**Y, **Participants No:**

Examination Date:/...../202...

	16	26
Gingival margin Plaque Gingival Index Bleeding on probing Probing depth		
Buccal		
Palatal		
Gingival margin Plaque Gingival Index Bleeding on probing Probing depth		

12.7 ANNEX 7. PATIENT CONSENT



عيادة سواك لطب الأسنان
تقويم وتجميل الأسنان

د. محمود نهاد المغني

نموذج إقرار بالموافقة على المشاركة بدراسة بحث/دراسة سريرية

Acknowledgment form of consent to participate in a research study/clinical study

أنت مدعو(ة) للمشاركة ببحث علمي سريري خاص بالدكتور محمود نهاد المغني ، الرجاء أن تأخذ(ي) الوقت الكافي لقراءة المعلومات التالية بتأن قبل أن تقرر(ي) إذا كنت تريد(ين) المشاركة أم لا. بإمكانك طلب إيضاحات أو معلومات إضافية عن أي شيء مذكور في هذه الإستمارة أو عن هذه الدراسة ككل من طبيبك. علماً بأنك لن تتحمل أي تكاليف.

You are invited to participate in clinical scientific research by Dr. Mahmoud N. M. Almughany. Please take your time to read the following information carefully before deciding whether or not you want to participate. You can request clarification or additional information about anything mentioned on this form or about this study as a whole from your doctor. Note that you will not bear any costs.

1. Information about the study:

Study title: Comparing the changes of periodontal parameters between banded and bonded teeth during fixed orthodontic treatment.

2. Principal investigator: Dr. Mahmoud N. M. Almughany

3. Principal Investigator Address: Palestine - Gaza

4. Study Place: Siwak Dental Clinic - Gaza

5. Aim of study:

To assess the effect of molar bands and bonded tubes on periodontal health of banded and bonded upper first molars treated with a fixed orthodontic appliance

6. Duration of participation in this study:

The duration of your participation in this study is approximately 6 months, where the periodontal examination will be carried out at intervals. The first visit will be on the day of installing the orthodontic appliance, the second visit after 3 months and the third visit after 6 months.

7. The number of participants in this study:

The expected total number of participants in this study will be 15 participants.

8. Study methodology:

Before your agreement to participate in this study, know that you have the opportunity to ask questions to the study researcher.

There will be 3 visits to participate in this research. The first visit will be on the day of installing the orthodontic appliance, the second visit after 3 months, and the third visit after 6 months.

In these visits, we will examine the Periodontal parameters and fill a certain periodontal chart, which will then be analyzed to obtain the desired results from this research.

Points that will be examined for the gums: plaque index, Pocket depth, bleeding on probing, gingival index.

9. Risks, side effects and inconveniences: none

10. Participation costs in this study: none

1. معلومات عن الدراسة:

عنوان الدراسة: مقارنة التغيرات في اللثة بين الأسنان الملتصقة والمربوطة أثناء علاج تقويم الأسنان الثابت

2. الباحث الرئيسي: د. محمود نهاد المغني

3. عنوان الباحث الرئيسي: فلسطين - غزة

4. مكان الدراسة: عيادة سواك لطب الأسنان - غزة

5. أهداف الدراسة:

لتقييم تأثير اللواصق والأربطة على صحة اللثة للأضراس العلوية الأولى الملتصقة والمربوطة والمعالجة بجهاز تقويم أسنان ثابت.

6. مدة المشاركة بهذه الدراسة :

مدة مشاركتك بهذه الدراسة 6 أشهر تقريباً ، حيث سيتم عمل فحص اللثة على فترات متباعدة، ستكون الزيارة الأولى يوم تثبيت جهاز التقويم والزيارة الثانية بعد 3 أشهر والزيارة الثالثة بعد 6 أشهر.

7. عدد المشاركين بهذه الدراسة:

العدد الكلي المتوقع للمشاركين بهذه الدراسة سيكون 35 مشارك.

8. منهجية الدراسة:

قبل موافقتك على المشاركة في هذه الدراسة ، أعلم أنه لديك الفرصة لطرح الأسئلة لباحث الدراسة.

ستكون هناك 3 زيارات للمشاركة في هذا البحث ستكون الزيارة الأولى يوم تثبيت جهاز التقويم والزيارة الثانية بعد 3 أشهر والزيارة الثالثة بعد 6 أشهر.

سنقوم في هذه الزيارات بفحص اللثة وتعبئة بيانات معينة خاصة باللثة والتي سيجري تحليلها بعد ذلك للحصول على النتائج المرجوة من هذا البحث.

النقاط التي سيتم فحصها للثة : مؤشر البلاك (القرسبات) ، قياس عمق الجيوب اللثوية ، النزف ، حافة اللثة ومستواها.

9. المخاطر والأعراض الجانبية و الإنزعاجات: لا يوجد

10. تكاليف المشاركة في هذه الدراسة: لا يوجد

0599039066

سواك لطب الأسنان - Siwak Dental Clinic

غزة - شارع عمر المختار مقابل منزله البلدية عمارة الجارذل.

11. Information about participation:

Your participation in this study is voluntary. You have the full right to decide whether or not to accept, but when you accept, we ask you to fully comply with the instructions, and if there is a refusal, this will not affect the medical care provided to you.

The study doctor has the right to terminate your participation in this study, based on your health condition, or if you do not comply with the visits and procedures prescribed in this study.

12. Confidentiality of information: Your information will be treated with complete confidentiality and only the principal investigator will see your data

أفهم أن مشاركتي في هذا البحث تطوعية و أعلم انه يحق لي الانسحاب متى قررت ذلك دون أن يؤثر ذلك على الرعاية الطبية التي أتلقاها عادةً و أفهم أيضا أنه يحق لباحث الدراسة الرئيسي إنهاء مشاركتي حسب ما يراه مناسباً لي. و أفهم أيضاً أن عدم الإلتزام بإجراءات البحث و مواعيد الزيارات قد يتسبب في إنهاء مشاركتي في الدراسة.
بتوقيعي على هذه الموافقة المبنيه على الإطلاع أقر بأنني تلقيت معلومات كافيه عن الدراسة وأنتي قد قرأت وفهمت المعلومات الموجوده في هذه الموافقة المبنيه على الإطلاع و أتيجت لي الفرصة لمناقشة الدراسة و طرح الأسئلة و قد كنت راض عن التفسيرات التي تلقيتها.
من خلال توقيع وتاريخ هذه الموافقة المبنيه على الإطلاع، أنا أوافق على المشاركة في هذه الدراسة البحثية.

13. Acknowledgment by the patient to participate in the research:

I understand that my participation in this research is voluntary and I know that I have the right to withdraw whenever I decide to do so without affecting the medical care I usually receive, and I also understand that the principal study investigator has the right to terminate my participation as he sees fit for me. I also understand that non-compliance with the research procedures and the dates of visits may cause my participation in the study to be terminated.

By signing this informed consent, I acknowledge that I have received sufficient information about the study, that I have read and understood the information contained in this informed consent, and that I have had the opportunity to discuss the study and ask questions, and I am satisfied with the explanations I received.

By signing and dating this informed consent, I agree to participate in this research study.

11. معلومات حول المشاركة :

إن مشاركتك في هذه الدراسة تطوعية . لك الحق التام في إتخاذ القرار بالموافقة أو الرفض، ولكن عند قبولك نرجو الإلتزام التام بالتعليمات وإذا كان هناك رفض فإن ذلك لن يؤثر ذلك على العناية الطبية المقدمة لك.

يحق لطبيب الدراسة إنهاء مشاركتك في هذه الدراسة وذلك بناءً على حالتك الصحية ، أو في حال عدم التزامك بالزيارات و الإجراءات المقررة في هذه الدراسة.

12. سرية المعلومات: سوف تعامل معلوماتك بسرية كاملة و لن يطلع على بياناتك سوى الباحث الرئيسي.

13. إقرار المريض بالمشاركة في البحث:

أفهم أن مشاركتي في هذا البحث تطوعية و أعلم انه يحق لي الانسحاب متى قررت ذلك دون أن يؤثر ذلك على الرعاية الطبية التي أتلقاها عادةً و أفهم أيضا أنه يحق لباحث الدراسة الرئيسي إنهاء مشاركتي حسب ما يراه مناسباً لي. و أفهم أيضاً أن عدم الإلتزام بإجراءات البحث و مواعيد الزيارات قد يتسبب في إنهاء مشاركتي في الدراسة.
بتوقيعي على هذه الموافقة المبنيه على الإطلاع أقر بأنني تلقيت معلومات كافيه عن الدراسة وأنتي قد قرأت وفهمت المعلومات الموجوده في هذه الموافقة المبنيه على الإطلاع و أتيجت لي الفرصة لمناقشة الدراسة و طرح الأسئلة و قد كنت راض عن التفسيرات التي تلقيتها.
من خلال توقيع وتاريخ هذه الموافقة المبنيه على الإطلاع، أنا أوافق على المشاركة في هذه الدراسة البحثية.

13. Acknowledgment by the patient to participate in the research:

I understand that my participation in this research is voluntary and I know that I have the right to withdraw whenever I decide to do so without affecting the medical care I usually receive, and I also understand that the principal study investigator has the right to terminate my participation as he sees fit for me. I also understand that non-compliance with the research procedures and the dates of visits may cause my participation in the study to be terminated.

By signing this informed consent, I acknowledge that I have received sufficient information about the study, that I have read and understood the information contained in this informed consent, and that I have had the opportunity to discuss the study and ask questions, and I am satisfied with the explanations I received.

By signing and dating this informed consent, I agree to participate in this research study.

Date / التاريخ

Signature / التوقيع

اسم المشارك / Participants

Date / التاريخ

Signature / التوقيع

اسم الوصي القانوني / Legal guardian's name

If the participant is a (less than 18 years old) / إذا كان المشارك لأقل من 18 سنة

Date / التاريخ

Signature / التوقيع

اسم الشاهد / Witness name

Date / التاريخ

Signature / التوقيع

اسم الباحث الرئيسي / Principal investigator name

12.8 ANNEX 8. JOB ACCEPTANCE LETTER. RCOE

RCOE



Dr. Mahmoud Almughany
malmughany@hotmail.com

Madrid, 11 de septiembre de 2024

Estimado compañero:

En nombre del Comité Editorial de la Revista RCOE del Consejo General de Odontólogos y Estomatólogos de España, es un honor para nosotros comunicarte que tu trabajo científico original titulado **"Cambios de los parámetros periodontales utilizando bandas molares y tubos adheridos en el tratamiento de ortodoncia fija en pacientes de ortodoncia en la franja de Gaza, Palestina"** ha sido aceptado para su publicación.

En las próximas semanas te podremos comunicar la fecha aproximada de publicación en nuestra Revista.

Muchas gracias por haber remitido tu trabajo a nuestra Revista RCOE.

Un fuerte abrazo.

José María Suárez Quintanilla
Director de RCOE

12.9 ANNEX 9. PERMISSION TO REPRODUCE PAPER

- Title:** **Banded vs. Bonded: Which Orthodontic Attachment Preserves Periodontal Health, Six Months study**
- Author:** Mahmoud N. Almughany*
- Affiliations:** Faculty of Medicine and Dentistry, University de Santiago de Compostela. Head of the dental department, University of Palestine, Gaza strip, Palestine
- Journal:** International Journal of Oral Health Dental Management (IJOHDM)
- Impact Factor:** peer-reviewed, open access journal (New)
- ISSN:** 2577-6533
- Editorial:** CME Live Open Access
- Publications Date:** 31 of August 2025
- DOI:** 10.64030/2577-6533
- Author contribution:** Conceptualization and Writing, review and editing
- Permission of (IJOHDM):** We are happy to confirm that you have permission to use the figures from our published article, “Banded Vs. Bonded: Which Orthodontic Attachment Preserve Periodontal Health, Six Months Study” in your PhD thesis.

Title: **Orthodontic Banding and Gingival Health: A Six-Months Study from Gaza Strip, Palestine**

Author: Mahmoud N. M. Almughany*

Affiliations: PhD Scholar at the Doctoral Programme at Faculty of Medicine and Dentistry, University de Santiago de Compostela, Spain. Head of Dental Department, University of Palestine, Gaza, Palestine

Journal: Online Journal of Dentistry & Oral Health (OJDOH)

Impact Factor: 1.523 (2023-24)

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Editorial: Iris Publishers LLC

Publications Date: 01 of July 2025

DOI: 10.33552/OJDOH.2025.08.000702

Author contribution: Conceptualization and Writing, review and editing

Permission of (OJDOH): Permission is hereby granted to use the figures from your article, “Orthodontic Banding and Gingival Health: A Six-Months Study from Gaza Strip, Palestine,” in your PhD thesis.

12.10 ANNEX 10. ETHICAL APPROVAL

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

Acknowledgment form of consent to participate in a research study/clinical study form was done. Each patient has the eligibility criteria to participate in the research was informed about the research goal and importance, risks and side effects, information about the participation and the confidentiality of the information.

This consent signed by participants or legal guardian, witness, and principal investigator.

This consent written in two languages, Arabic and English languages.

Arabic for participants to read and sign by their mother language and by English for research and University requirement.



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.

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.

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.