

Gingival health condition and salivary physical properties among a group of patients with intermaxillary fixation in tow times intervals (Follow up study)

Entiqal N. Jasim Al-Wazni, B.D S., H.D., M.Sc.⁽¹⁾

Nadia A. Al- Rawi, B.D.S., M.Sc., Ph.D.⁽²⁾

ABSTRACT

Background: One of the methods used in the treatment of maxillofacial fracture is intermaxillary fixation(IMF), the most common type is the Erich arch bar with interdental wiring. This study was conducted to investigate the impact of intermaxillary fixation on gingival health condition among a group of patients with facial fracture in relation to salivary physical properties.

Materials and methods: Thirty patients with an age range of (17-37) years old with facial fractures and indicated for IMF. Plaque index and gingival index (Loe, 1967) were used to assess both of them before application and after removal of IMF. Unstimulated saliva sample collection was carried out under standardized conditions according to Navazesh and Kumer (2008) before IMF application and after removal to measure salivary flow rate and viscosity. Analysis of data was carried out using SPSS (version 18).

Results: A higher mean values of plaque and gingival index were recorded after IMF removal than that before IMF application, with highly significant changes ($p<0.01$). In regarding to salivary physical properties, salivary flow rate mean values was lower after IMF removal than before IMF application with statistically highly significant changes ($p<0.01$). Concerning salivary viscosity, it has been found that a higher mean values after IMF removal than before IMF application with highly significant changes ($p<0.01$).

Conclusion: The results of current investigation revealed that intermaxillary fixation (Arch bar) have a significant effects on gingival health in addition to disturb normal level of certain salivary physical properties.

Key words: Intermaxillary fixation, facial fracture, gingival health condition, salivary physical properties. (*J Bagh Coll Dentistry 2017; 29(1):132-138*)

INTRODUCTION

Intermaxillary fixation is a technique used to stabilize a fractured jaw involving maxilla, mandibular complex both for closed reduction and adjuvant to open reduction⁽¹⁾. Various types of tooth mounted devices like arch bar, dental and interdental wiring, metallic and non metallic splints are used to achieve intermaxillary fixation⁽²⁾.

The time of intermaxillary fixation which may last for 6 weeks, may be associated with general and oral problems like: weight loss, intense emotional stress, poor oral hygiene, periodontal health problem, loss of tooth vitality, extrusion of teeth, in addition to traumatic ulcer of buccal mucosa^(3, 4, 5).

Saliva is the principal defense mechanism and maintaining the health of the oral tissue.

Adequate salivary physical properties are critical to the maintenance of the health of the oral tissues⁽⁶⁾. Flow rate play very important function in flushing, dilute substance and neutralizing effect which referred as salivary clearance so higher flow rate faster clearance⁽⁷⁾.

Measuring salivary viscosity is of paramount important since an elevated salivary viscosity was found to be associated with an increased occurrence of oral disease⁽⁸⁾. There are no Iraqi studies relating salivary composition with oral problems among patients with IMF so this study was conducted to investigate the correlation of certain salivary variables among IMF patients with oral hygiene condition.

MATERIALS AND METHODS

The study sample included 30 patients , with an age range of 17- 37years, they were all with confirmed diagnosis of facial fracture and indicated for IMF application, the sample was divided according to the age into three age groups: (17-23) years, (24-30) years and (31-37) years. They were examined at the Imam Al-Hussein Medical Hospital in Karbala City, department of maxillofacial surgery for their treatment. Oral examination was done at the day of IMF application. Unstimulated salivary samples were collected for assessment of physical properties (flow rate and viscosity). Dental plaque and gingival inflammation were assessed at the time of IMF application by using Loe index⁽⁹⁾.The collection of unstimulated saliva sample was performed following the instruction cited by Navazsh and Kumer⁽¹⁰⁾ . Measurement of salivary viscosity by Ostwald

¹(M.Sc. student Department of Pedodonticsand Preventive Dentistry, University of Baghdad.

²(Assistant Professor, Department of Pedodonticsand Preventive Dentistry, University of Baghdad.

viscometer ⁽¹¹⁾. After six weeks of IMF application, and at day of IMF removal oral examination and unstimulated salivary sample collection were repeated for study sample. Analysis of data was carried out using SPSS (version 18), and the statistical tests that were used in this study, paired t-test and pearson correlation.

RESULTS

Result revealed that a high percentage of patients with facial fracture recorded among (17-23) years age group compared to the other two groups as seen in Table (1).

Table (2) represents a higher mean values of plaque index and gingival index among a group of patients with facial fracture after IMF removal than before IMF application with highly significant changes ($p < 0.01$).

Figure (1) illustrates the nominal scales of plaque index among the patients with facial fracture before IMF application and after removal. This study revealed that, the higher percentage was cited under the fair plaque scale followed by good plaque scale and poor plaque scale.

Figure (2) illustrates the nominal scales of gingival index among the patients with facial fracture before IMF application and after removal. This study revealed that, the higher percentage was cited under the moderate gingivitis scale followed by mild and sever gingivitis.

Table (3) presents rates of secretion of unstimulated saliva and viscosity among patients with facial fracture. Lower mean values of salivary flow rate after IMF removal than before application with highly significant changes ($p < 0.01$). Regarding salivary viscosity, higher mean values of salivary viscosity after IMF removal than before application with highly significant changes ($p < 0.01$).

Table (4) referred to the correlation coefficient of plaque index with gingival index in the patients with facial fracture before IMF application and after removal. A strong and positive statistically highly significant correlation were existed between plaque index with gingival index in the both times, before IMF application and after removal.

Regarding correlation between dental plaque index with salivary physical properties

Table (5) illustrates the correlation coefficient between plaque index with salivary flow rate (SFR) and viscosity among patient with facial fracture before IMF application and after removal. In general a week negative significant correlation were recorded between salivary flow rate and dental plaque before application and after IMF removal. Regarding salivary viscosity a positive significant correlation recorded with dental plaque before application of IMF and after removal.

Table (6) demonstrates the correlation coefficient between gingival index with salivary physical properties. The statistical results revealed that there is a negative significant relation between salivary flow rate and gingival inflammation. Also there is a negative non significant relation between salivary viscosity and gingival inflammation before IMF application and a positive non significant relation after IMF removal.

Table (1): Distribution of patients with facial fracture by age

Age (Year)	No.	%
17-23	11	36.666
24-30	9	30.000
31-37	10	33.333

Table (2): Plaque and gingival index (Mean and Standard Deviation) for total sample

Variable	Before IMF application	After IMF removal	Statistical test		
	Mean±SD	Mean±SD	t-value	df	p-value
(PII)	1.22±0.41	1.72±0.48	-7.483	29	0.000**
GI	1.24±0.37	1.78±0.33	-11.071	29	0.000**

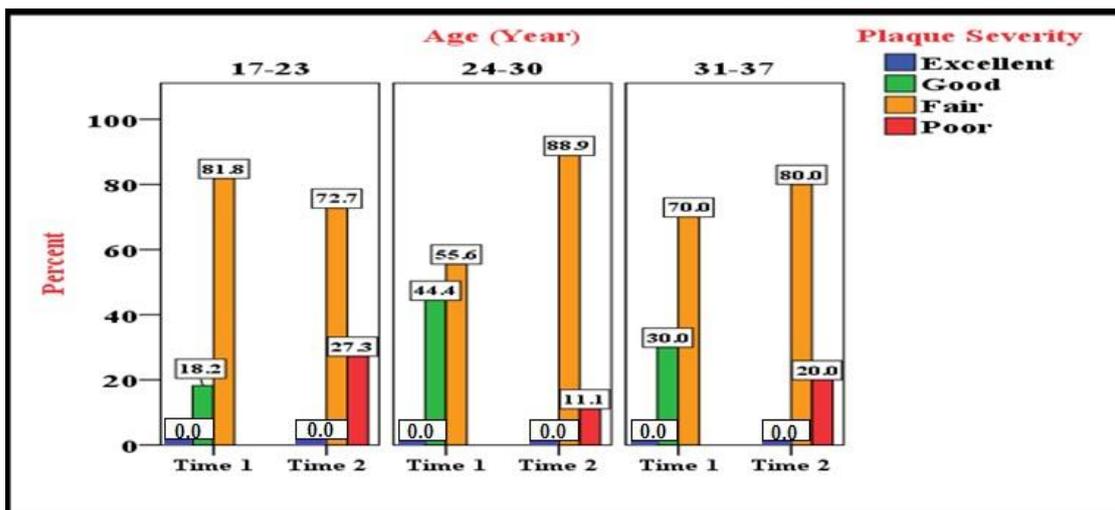


Figure (1): Plaque severity among patients with facial fracture before application of IMF and after removal.

* Time 1: Before application of IMF, Time 2: After removal of IMF

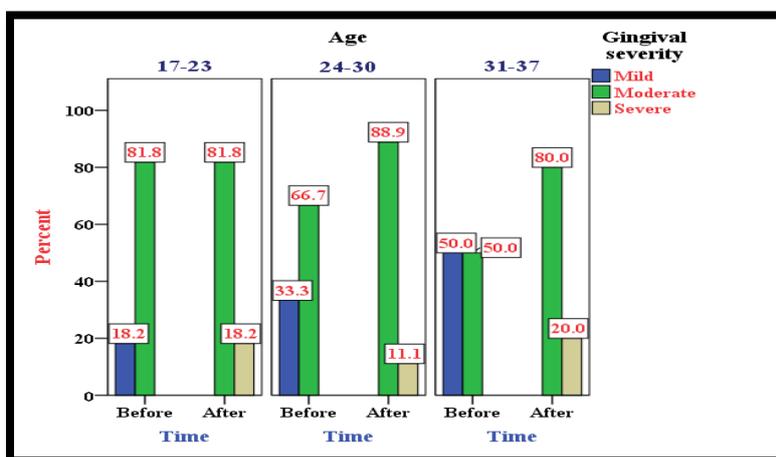


Figure (2): Gingival severity among patient with facial fracture before IMF application and after removal.

Table (3): Salivary flow rate and viscosity (Mean and Standard Deviation) for total sample

Variables	Before IMF application	After IMF removal	Statistical test		
	Mean±SD	Mean±SD	t-value	Df	P-value
Salivary flow rate (ml/min)	0.41±0.21	0.32±0.12	3.436	29	0.001**
Salivary viscosity (poise)	0.04±0.2	0.06±0.02	-11.35	29	0.001**

Table (4): Correlation coefficient between plaque index with gingival index for total sample

IMF application and removal	Variable	GI	
		r	P
Before IMF application	PII	0.730	0.000**
After IMF removal	PII	0.761	0.000**

Table (5): Correlation coefficient between plaque index with salivary flow rate and viscosity for total sample

IMF application and removal	Variable	Salivary flow rate		Salivary viscosity	
		r	P-value	r	P-value
Before IMF application	PII	-0.468	0.009**	0.414	0.023*
After IMF removal	PII	-0.261	0.164#	0.454	0.012*

Table (6): Correlation coefficient between gingival index with salivary flow rate and viscosity for total sample

IMF application and removal	Variable	Salivary flow rate		Salivary viscosity	
		r	P-value	r	P-value
Before IMF application	GI	-0.375	0.040*	-0.066	0.729
After IMF removal	GI	-0.112	0.555	0.121	0.523

DISCUSSION

Various methods have been used for IMF in management of mandibular fracture, one of the most common method in treatment of mandibular fracture is the application of Erich arch bar for IMF with circumdental wiring, Erich arch bars have been used in management of maxilla mandibular fracture since World War 1⁽²⁾. However this type of management has been linked with increased risk for oral diseases.

The present study (follow up study) was conduct to evaluate the effect of intermaxillary fixation (Erich arch bar) on gingival health condition in relation to salivary physical properties.

The patient's selected age were between (17-37) years old, because most of the patients with motor-vehicle accident with facial fracture with an average age of 20-35 years old⁽⁴⁾, in addition to that the most patients were attending to hospital with facial fractures and treating with IMF (Erich arch bar) with these range.

In order to provide evidence between the amount of plaque accumulation and gingival

inflammation, gingival index⁽⁹⁾, was used to assess gingival health condition, with plaque index⁽⁹⁾, these are widely used in epidemiological studies due to their ease, feasibility and validity, in addition to allow the assessment of the state by severity⁽¹²⁾.

In present study, the higher mean values of gingival index after IMF removal may be attributed to the higher mean values of plaque index, with highly significant changes compared to the same group of patients before IMF application, these finding was in agreement with other study that increased gingivitis in patients with IMF after removal⁽¹³⁾. Also high significant correlation between plaque index and gingival index among a group of patients with facial fracture before Application of IMF and after removal, this result was agreed with that record by Lone et al⁽¹³⁾, Reddy⁽¹⁴⁾.

Unfortunately, there are no previous Iraqi studies concerning effect of IMF application on gingival health condition to compare with it. However; the present follow up study revealed that higher PII and GI among patients after IMF removal than in patients before IMF application,

one of explanation may be due to Erich arch bar that used for treatment of facial fractures with circumdental wiring, the wire pass below the gingival margin and has disadvantages: injury to gingival tissues, compromised the health of periodontium, rounded wire edges collect food debris cause gingival inflammation and difficulty in maintaining oral hygiene⁽²⁾.

Another explanation, patients with facial fracture under emotional stress, which effects on gingival inflammation either by direct influence of stress on immune system (biologic model), through release of stress hormones or by an influence of increase plaque accumulation during stressful experiences period leading to gingival inflammation, as the plaque is the causative factor of gingival inflammation (behavioral model), through the change in life-style such as ignoring self-oral health measures and inappropriate cariogenic diet, both models resulting in increasing susceptibility to periodontal diseases^(15, 16).

In the present study increase gingivitis in addition to plaque accumulation may be due to trauma from wiring which may lead to increase in gingival inflammation, this factor demonstrate the direct impact of IMF on gingival condition⁽¹⁷⁾.

Stooky in 2008 reported that saliva through its flow rate and constituents may play an essential role in maintaining the integrity of the hard and soft oral tissues, and reflecting a physiological status of the oral cavity⁽¹⁸⁾.

This study revealed that patients with IMF after removal, had a lower mean value of salivary flow rate compare to the same patients before application of IMF, these finding may be attributed to several cause, one of them is that salivary flow rate affect by several factor (medication, position of individual, hydration, nutrition)^(5, 19). Patients with facial fracture usually under analgesic to relief the pain, so these medication play a role in decreasing the flow rate of saliva. Also patients with facial trauma most of time with laying position and salivary flow rate is more in standing position than in under laying position^(6, 19).

Patients with trauma had a difficulty in drinking and improper eating this will lead to dehydration, the degree of individual hydration is the most important factor that affect salivary secretion. When the body water content is reduced by 8%, salivary flow rate virtually diminishes to zero, whereas hyper hydration causes an increase in salivary flow rate⁽¹⁹⁾. During dehydration salivary gland cease secretion to conserve water. Additionally, other

explanation for these findings, patients with facial fracture treated with IMF under emotional disturbances (anxiety, stress, and depression) this condition produce transient reduction in salivary flow and change in salivary components⁽²⁰⁾. Another explanation for decrease of salivary flow rate in patients with facial fracture treated with Erich arch bar after IMF removal is that application of arch bar, patients can not open the mouth this condition resemble to the patients when sleeping so no secretion of saliva and lead to decrease in saliva flow rate⁽²¹⁾.

Lower salivary flow rate among a group of patients after IMF removal with highly significant, the result can be explained by that the flow rate of saliva may play important role in relation to plaque accumulation, so decrease in flow rate of saliva lead to decrease of washing action of saliva which lead to oral dryness as well as decrease of protective constituents⁽²¹⁾.

Salivary flow rate in this study was negatively correlated with dental plaque and gingival indices. This result was in agreement with Iraqi studies found an inverse relation between salivary flow rate and gingival index⁽²²⁻²⁴⁾, this could be attributed to the fact that saliva exerts a major influence on plaque initiation and maturation⁽²⁵⁾.

Salivary viscosity is a quality or state of being viscous, relates to the glycoprotein content of saliva^(26, 27). Viscoelastic properties are essential for humidification and lubrication which providing mucosal integrity⁽²⁸⁾. An increased salivary viscosity increased oral health problem^(8, 29). In the present, investigation salivary viscosity is higher after IMF removal compare with the mean values before IMF application, an explanation of increase in salivary viscosity in addition to the factor related with decrease salivary flow rate, is that patients with facial fracture suffer from emotional disturbance (anxiety, stress) so, sympathetic stimulation produces little saliva but of high protein concentration⁽³⁰⁻³²⁾. However, this elevation in the total protein could be attributed to sympathetic activation during stress as the sympathetic innervations of the salivary glands controls protein secretion^(33, 34). However no significant correlation has been recorded between salivary viscosity ad gingival inflammation. This result in agreement with Al-Awadi and Yas^(23,35). Data of present study show a positive correlation between plaque index and salivary viscosity.

REFERENCES

- Coletti D, Salama A, Caccamese J. Application of intermaxillary fixation screws in maxillofacial trauma. *J Oral Maxillofac Surg* 2007; 56(9): 1746 -1750.
- Chandan S, Ramanojam S, Comparative evaluation of the resin bonded arch bar versus conventional Erich arch bar for intermaxillary fixation. *J Maxillofac Oral Surg* 2010; 9: 231 - 5.
- Booth P, Schendel S, Hausamen J. *Maxillofacial surgery*. 2nd ed. Churchill Livingstone, 2007.
- Hupp J, Ellis E, Tucker M. *Contemporary Oral and Maxillofacial Surgery*. 5th ed. Mosby, Elsevier, 2008.
- Sheet W, Hassouni M. Changes in the body weight, serum (sodium, potassium and serum albumin) after intermaxillary fixation in traumatized and obese patients (A comparative study). *Al- Rafidain Den J*. 2012; 12(1): 52-56.
- Puy C. The role of saliva in maintaining oral health and as aid in diagnosis. *Med Oral Pathol Oral Cir Bucal* 2006; 11(5): 449- 455.
- Gandhy M, Damle G. Relation of salivary inorganic phosphorus and alkaline phosphatase to the dental caries status in children. *J Indian Soc Pedod Prev Dent*. 2003 Dec; 21(4): 135 - 8.
- Hirotohi T, Yoshihara A, Ogawa H, Ito K, Igarashi A, Miyazaki H. A preliminary study on the relationship between stimulated saliva and periodontal conditions in community dwelling elderly people. *J Dent* 2006; 34 (9): 692- 8.
- Loe H. The gingival index, the plaque index and the retention index system. *J Periodontol*, 1967; 38(6): 610 - 616.
- Navazesh M, Kumar S. Measuring salivary flow Challenges and opportunities. *JADA* 2008; 139(5): 35-40.
- Shridar R. Century of Noble prize. 1909 Chemistry Laureate Wilhelm Chem. Educ. 2002; 79: p 149.
- Ciancio G. Status of indices of gingivitis. *J clin periodontol* 1986; 13: 375 - 367.
- Lone P, Singh M, Salgotra V, Johar H. Role of oral prophylaxis with the use of Erich arch bars: A randomized controlled Trial. *Int J Sci Stud* 2015; 3(7): 18-22.
- Reddy S. *Essentials of clinical periodontology and periodontics*. 2nd ed. Jaypee Brothers Medical Publishers, New Delhi, 2008.
- Genco J, Alex O, Jeffrey K, Grossi G, Dunford G, Tedesco A. Models to evaluate the role of stress in periodontal disease. *Ann Periodontol* 1998; 3(1): 288 - 302.
- Boyapati L, Wang H. The role of stress in periodontal disease and wound healing. *Periodontology* 2000 May 2007; 44(1):195-210.
- Lello J, Lello G. The effect of interdental continuous loop wire splinting and intermaxillary fixation on the marginal gingiva. *Int J Oral Maxillofac Surg* 1988; 17(4): 249 - 252.
- Stooky K. The effect of saliva on dental caries. *J Am Dent Assoc* May 2008; 139(Suppl): 11S-17S.
- Edgar M, Dawes C, O'Mullane D. *Saliva and oral health*. 3th ed. British Dental Association. London: BDJ Books, 2004.
- Buduneli N, Kinane F. Host-derived diagnostic markers related to soft tissue destruction and bone degradation in periodontitis. *J Clin Periodontol* 2011; 38(11): 85-105
- Lenander-Lumikari M, Loimaranta V. Saliva and dental caries. *Adv Dent Res* 2000; 14: 40 -7.
- Masood N. Oral health status and dental treatment needs in relation to salivary constituents and parameters among a group of patients with hypertension. M.Sc. Thesis, College of Dentistry, University of Baghdad, 2010.
- Al- Awadi RN. Oral health status, salivary physical properties and salivary mutans streptococci among a group of mouth breathing patients in comparison to nose breathing (comparative study). Master Thesis, College of Dentistry, University of Baghdad, 2012.
- Mahammed A. Oral health status and salivary physicochemical characteristics among overweight intermediate school females aged 13-15 years in Babylon- Iraq. Master thesis, college of Dentistry, University of Baghdad, 2013.
- Carranza F, Forrest J, Kenny E, Takei H, Karimbux N, Klokkevold P, Newman M, Novak M. Carranza's *Clinical Periodontology*. 11th ed. Saunders, Elsevier Inc. 2011.
- Nazhat M. Evaluation of physical and chemical properties of saliva, and its effects on the retention of acrylic resin denture base. M. Sc. Thesis, College of Dentistry, University of Mousl, 2003
- Hurlbutt M, Novy, Young D. Dental caries: A pH-mediated disease. *CDHA J* 2010; 25(1): 9 – 15.
- Schenkels L, Veerman E, Amerongen A. Biochemical composition of human saliva in relation to other mucosal fluid. *Crit Rev Oral Biol Med* 1995; 6(7): 385-389.
- Zussman E, Yarin A, Nagler R. Age- and flow-dependency of saliva viscoelasticity. *JDR* 2007; 86(3): 281-285.
- Carlson W. *The salivary glands*. Embryology, anatomy, and surgical actions. *SurgClin North Am*. 2000; 80:261-273.
- Lawrence P. Salivary markers of systemic disease: non-invasive diagnosis of disease and monitoring of general health. *J Can Dent Assoc* 2002; 68(3): 170- 174..
- Turner J, Sugiya H. Understanding salivary fluid and protein secretion. *Oral Dis* 2002; 8(1): 3-11
- Bosch J, Brand H, Ligtenberg T, Bermond B, Hoogstraten J, Amerongen N. Psychological stress as a determinant of protein levels and salivary-induced aggregation of *Streptococcus gordonii* in human whole saliva. *Psychosom med* 1996; 58(4): 374- 82.
- Carpenter H, Garrett R, Hartley H, Proctor B. The influence of nerves on the secretion of immunoglobulin A into submandibular saliva in rats. *J Physiol* 1998; 512: 567-573.
- Yas B. Salivary antioxidant and physicochemical characteristics related to oral health status among a group of old adults. Ph.D. Thesis submitted to the Collage of Dentistry, University of Baghdad, 2009.

الخلاصة

المقدمة: واحدة من الاساليب التي تستعمل لعلاج كسور الوجه والفكين هي تثبيت الفكين. والانواع الاكثر شيوعا هي شريط قوس اريك مع الاسلاك بين الاسنان.

أهداف الدراسة: تهدف الدراسة إلى بيان تأثير تثبيت الفكين على الحالة الصحية للثة بين مجموعة من المرضى يعانون كسر في الوجه. فيما يتعلق بالخصائص الفيزيائية لللعابية.

المواد وطرق العمل: تتضمن العينة ثلاثون مريض للفئة العمرية 17-37 سنة، يعانون من كسور في الوجه والفكين، تم علاجهم عن طريق تثبيت الفك السفلي بالفك العلوي. تم قياس الصفيحة الجرثومية والتهاب اللثة باستخدام (Loe, 1967) قبل التثبيت وبعد رفع التثبيت. تم جمع عينات اللعاب غير المحفز في ظل ظروف موحدة وطريقة (Navazesh and Kumer, 2008) قبل التثبيت وبعد رفع التثبيت، تم قياس معدل تدفق اللعاب والزوجة. اجري تحليل البيانات باستخدام نظام SPSS الاصدار 18.

النتائج: اظهرت نتائج الدراسة الحالية ان متوسط قيمة الصفيحة الجرثومية كان اعلى بين المرضى بعد ازالة التثبيت منه قبل وضع التثبيت مع تغيرات معنوية عالية ($P<0.01$). متوسط قيمة التهاب اللثة كان اعلى بين المرضى بعد ازالة التثبيت منه قبل وضع التثبيت مع تغيرات معنوية عالية ($P<0.01$). معدل تدفق اللعاب غير المحفز كان اقل بعد ازالة التثبيت منه قبل وضع التثبيت مع تغيرات معنوية عالية ($P<0.01$). اظهرت الدراسة عدم وجود اي ارتباط بين الصفيحة الجرثومية ومعدل تدفق اللعاب بعد ازالة التثبيت مع وجود علاقة سلبية عالية قبل وضع التثبيت. بالنسبة للعلاقة بين التهاب اللثة و معدل تدفق اللعاب هناك ارتباط سلبي قبل وضع الربط وبعده.

معدل اللزوجة كان أعلى بعد إزالة التثبيت منه قبل وضع التثبيت مع تغيرات معنوية عالية ($P<0.01$). اظهرت الدراسة وجود علاقة بين لزوجة اللعاب و معدل تدفق اللعاب و الصفيحة الجرثومية قبل التثبيت وبعد رفعه مع عدم وجود علاقة بين لزوجة اللعاب والتهاب اللثة قبل التثبيت و بعد رفعه.

الاستنتاجات: أثبتت نتيجة البحث الحالي إن لتثبيت الفكين اثار جانبية على صحة اللثة بالإضافة إلى الإخلال بالمستوى الطبيعي لمكونات اللعاب الفيزيائية.