



Research Article

Association of Frenum Attachments with Age and Gender in a Sample of Iraqi People: A Cross-Sectional Study

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Abstract

Background: The labial frenum is a thin fold of oral mucosa that contains muscle fibers. It connects the lips to the tissues and bones around the upper and lower teeth. **Objective:** To assess the various types of labial frenal attachments in the upper and lower jaws, as well as their relationship with age and gender, in a sample of the Iraqi population. **Methods:** The study includes 1,939 subjects (978 males and 961 females) with an age range of 10 to 70 years. These individuals visited the Periodontics Department of Dentistry at Al-Rafidain University College in Baghdad, Iraq, from October 2021 to April 2023. The patients were categorized into age subgroups: 10–30 years, 31–50 years, and 51–70 years. Descriptive statistics estimate frequencies and percentages, and the Chi-square test compares the results. **Results:** The total number of labial frenum attachments, encompassing both upper and lower attachments, varies between males and females. There are 1397 gingival attachments (36.02%), 1793 mucosal attachments (46.24%), 567 papillary attachments (14.62%), and 121 papillary penetrating attachments (3.12%) in both sexes. In both sexes, there is a significant correlation between age and different upper and lower labial frenum attachment categories. Additionally, there is a significant correlation between gender and the upper and lower labial frenum attachment categories. **Conclusions:** In the maxilla, the gingival attachment was more prevalent, followed by the mucosal attachment. However, we detect the mucosa attachment in the mandible, followed by the gingiva attachment. There was a significant relationship between frenum attachment, age, and gender.

Keywords: Age, Attachment, Frenum attachment, Gender, Gingival mucosa.

العلاقة بين ارتباط الفرينوم بالعمر والجنس لدى عينة من الشعب العراقي: دراسة مقطعية

الخلاصة

الخلفية: اللجام الشفوي هو طية رقيقة من الغشاء المخاطي للفتحتي على ألياف العضلات. يربط الشفاه بالأنسجة والعظام حول الأسنان العلوية والسفلية. **الهدف:** تقييم الأنواع المختلفة من المرفقات الكظرية الشفوية في الفكين العلوي والسفلي، وكذلك علاقتها بالعمر والجنس، في عينة من السكان العراقيين. **الطرق:** شملت العينة 1939 شخصاً، منهم 978 ذكراً و961 أنثى، وتتراوح أعمارهم بين 10 إلى 70 عاماً. قام هؤلاء الأفراد بزيارة قسم أمراض اللثة وطب الأسنان في كلية الرافديان الجامعة في بغداد، العراق. أجريت هذه الدراسة في الفترة من أكتوبر 2021 إلى أبريل 2023. وتم تصنيف المرضى إلى مجموعات فرعية عمرية: 10-30، و31-50، و51-70 عاماً. **النتائج:** العدد الاجمالي لمرفقات اللجام الشفوي، بما في ذلك المرفقات العلوية والسفلية، في الذكور والإناث هو كما يلي: اللثة 1397 (36.02%)، الغشاء المخاطي 1793 (46.24%)، الحلبي 567 (14.62%)، الحلبي المخترق 121 (3.12%). بالمرفقات هناك علاقة ذات دلالة إحصائية بين الفئات العمرية ومختلف فئات ارتباط اللجام الشفوي العلوي والسفلي في كل من الذكور والإناث. بالإضافة إلى ذلك، يوجد ارتباط كبير بين الجنس (الذكور والإناث) وفئات ارتباط اللجام الشفوي العلوي والسفلي. **الاستنتاج:** يُظهر اتصال اللجام الشفوي بالفكين العلوي والسفلي تبايناً كبيراً. اكتشفت هذه الدراسة أنه في الفك العلوي، كان التصاق اللثة أكثر شيوعاً، يليه التصاق الغشاء المخاطي. على العكس من ذلك، في الفك السفلي، تم اكتشاف التصاق الغشاء المخاطي بشكل أكثر شيوعاً، يليه التصاق اللثة. بالإضافة إلى ذلك، أظهرت هذه الدراسة أن هناك علاقة ذات دلالة إحصائية بين تعلق اللجام.

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INTRODUCTION

The frenum is defined as a mucous membrane fold that connects the cheek and lip to the gingiva, alveolar mucosa, and underlying periosteum. Extreme proximity of the frenum to the gingival margin can disrupt gingival strength, making it challenging to maintain oral hygiene

and leading to muscular tension [1,2]. Mirko *et al.* have classified the attachments of the labial frenal into four distinct groups: The term "gingival" describes the process of inserting fibers into the attached gingiva, while "mucosal" describes the area where the mucogingival connection and frenal fibers merge [3]. Papilla penetrating refers to the condition in which

frenal fibers cross the alveolar process and spread up to the palatine papilla, whereas papillary refers to the state in which strands encompass the interdental papilla. The labial frenum's main functions are to support and stabilize the upper lip, maintain harmony between the lip and developing maxillary bones, and control facial development [4]. In addition, the frenum is an important anatomical structure during complete denture fabrication [5]. Abnormal frenal attachment could impact the retention and fit of the maxillary full denture. A slight deviation in the fundamental labial bone margin, coupled with extreme frenal pull, can cause the start and progression of gingival recession and subsequent bone corrosion. Furthermore, it's important to carefully evaluate the labial frenum, as it may play a role in the development of perimucosities and peri-implantitis [6]. An inferior frenum attachment can disturb the movement of muscle tissues. Frenum attachment can affect the mobility of muscular structures, disrupting the jaw's positioning and tooth arrangement [7]. The maxillary frenum can also make the teeth look bad or affect the outcome of orthodontic treatment in cases of midline diastema, which could lead to a relapse after treatment [8]. The maxillary frenum changes human growth and development, typically shifting to an apical position as the alveolar process grows [9]. Abnormal frenal attachment creates a gap between teeth, which facilitates plaque buildup, causes the gingiva to recede, and leads to bone deterioration. Additionally, it hinders the ability to smile and speak correctly; all these elements can potentially cause psychological disruptions in people [10–14]. Additionally, reports say that the frenum is pathogenic if it is too wide, doesn't have a clear zone of gingiva along the midline [15], or changes the interdental papilla as it grows [16]. Data regarding the different forms of labial frenum attachments was lacking in Iraqi research. This study aimed to assess the different types of labial frenal attachments in the upper and lower jaws, as well as their relationship with age and gender, in a sample of the Iraqi population.

METHODS

Study design and setting

This is an observational cross-sectional study that was conducted between October 2021 and April 2023. The study primarily focused on frenum examinations and did not include any form of treatment.

Exclusion criteria

People with periodontitis, injuries to the upper or lower labial frenum or adjacent mucosa, surgery on the upper or lower frenum, or who are taking medications that affect gingival health are not eligible. Furthermore, any atypical upper or lower frenum or premaxilla due to

developmental or congenital abnormalities, as well as those with a cleft lip or palate, are also excluded.

Sample selection and outcome measurements

The study sample was collected using convenient sampling. The sample size was calculated using data from a pilot study conducted, as the prevalence is 5%. The formula used to calculate the sample size is: $n = (Z^2 \cdot P \cdot (1-P)) / d^2$, where $z = 2.58$ at a 99% confidence interval; p is the prevalence; d is the absolute margin of error to be tolerated; and p is the maximum prevalence of gingival frenal attachment taken from a pilot study, thus the sample size is approximated at 1900. This study was conducted among a randomly selected sample consisting of 1,939 participants, with 978 males and 961 females. The subjects were between the ages of 10 and 70. They were patients who visited the Periodontics Department of Dentistry at Al-Rafidain University College in Baghdad, Iraq, as indicated in Table 1.

Table 1: Distribution of the study sample based on age and gender

Age group (year)	Male n(%)	Female n(%)
10-30	376(38.45)	505(52.55)
31-50	471(48.16)	342(35.59)
51-70	131(13.39)	114(11.86)
Total	978(50.4)	961(49.6)

We categorized the patients into three age subgroups: 10–30, 31–50, and 51–70 years. The study received ethical approval from the research ethics committee of Al-Rafidain University College, reference number 12, on July 3, 2022, in compliance with the updated version of the Helsinki Declaration. The periodontist performed a frenum examination on the dental chair after obtaining written consent from the participants. A periodontist used direct vision under the dental unit's light to examine the frenum's shape, employing the blanching test and the pull test. According to Mirko's (1974) classification of frenum attachments, the periodontist recorded four types of frenum attachments: gingival, mucosal, papillary, and papillary penetrating. In this test, the periodontist carefully stretched the patient's lips using both hands, specifically the index finger and thumb, to mirror the upper and lower lips. The atypical frenum was visually assessed by applying stress to observe the movement of the papillary tip or any blanching caused by reduced blood flow to the area, known as "ischemia." The study of frenum attachment includes both intra- and inter-examiner calibration. Ten arbitrarily chosen contributors will be hired for each intra- and inter-examiner calibration. For intra-examiner calibrations, the same periodontist assessed frenum attachments twice, ideally within two hours of each other or the day after the first examination. This is critical to lowering the possibility that an examiner will remember formerly recognized exams. Moreover, the gap permits the frenum to return to its original position before

examination. Each patient will be considered by two periodontists in two schedules spaced out seven days apart for inter-examiner calibrations. Both periodontists will inspect patients throughout each session [18].

Statistical analysis

Data description, analysis, and presentation were performed using the Statistical Package for Social Science (SPSS version 22, Chicago, Illinois, USA). Descriptive statistics are used to estimate frequencies and percentages. The comparison is performed using the chi-square test. The level of significance is considered at a *p*-value less than 0.05.

RESULTS

The present study included a total of 1,939 patients, out of which 978 (50.4%) were men. The remaining 961 patients, accounting for 49.6% of the total, were female. The number of men in the age category of 10–30 years is 376, which accounts for 38.45% of the total. The number of females is 505, making up 52.55% of the total. Furthermore, 471 males (48.16%) and 342 females (35.59%) are in the age category of 31–50 years. In addition, the count and percentage of males (131, 13.39%) and females (114, 11.86%) in the age group of 51–70 years are shown in Table 1. According to Table 2, the distribution of upper labial frenum attachments in males is as follows: 482 (49.28%) gingival, 209 (21.37%) mucosal, 244 (24.95%) papillary, and 43 (4.40%) papillary penetrating attachments.

Table 2: Correlation between the categories of the upper labial frenal attachment and age groups in males

Age group (year)	Upper labial frenum attachment in males				<i>p</i> -value
	Gingival	Mucosal	Papillary	Papillary penetrating	
10-30	207(37.23)	93(20.09)	140(30.24)	23(4.97)	0.00001
31-50	190(50.40)	102(27.06)	69(18.30)	16(4.24)	
51-70	85(60.71)	14(10)	35(25)	6(4.29)	
Total	482 (49.28)	209(21.37)	244(24.95)	43(4.40)	

In contrast, in males, the distribution of lower labial frenum attachments is as follows: 263 (26.89%) gingival, 657 (67.18%) mucosal, 40 (4.09%) papillary,

and 18 (1.84%) papillary penetrating attachments, as shown in Table 3.

Table 3: Correlation between age groups and categories of lower labial frenal attachment in males

Age group (year)	Lower labial frenum attachment in males				<i>p</i> -value
	Gingival	Mucosal	Papillary	Papillary penetrating	
10-30	12(25.64)	324(69.23)	16(3.42)	8(1.71)	0.0000
31-50	96(24.81)	276(71.32)	11(2.84)	4(1.03)	
51-70	47(38.21)	57(46.34)	13(10.57)	6(4.88)	
Total	263(26.89)	657(67.18)	40(4.09)	1 (1.84)	

Table 4 shows the number of upper labial frenum attachments in females. There are 503 (52.34%)

gingival, 150 (15.61%) mucosal, 254 (26.43%) papillary, and 54 (5.62%) papillary penetrating.

Table 4: Correlation between age groups and upper labial frenum attachment categories in females

Age group (year)	Upper labial frenum attachment in females				<i>p</i> -value
	Gingival	Mucosal	Papillary	Papillary penetrating	
10-30	265(48.45)	74(13.53)	170(31.08)	38	0.0000
31-50	185(51.25)	48(13.30)	64(17.73)	64(17.73)	
51-70	53(43.09)	28(22.76)	20(16.26)	22(17.89)	
Total	503(52.34)	150(15.61)	254(26.43)	54(5.62)	

A look at Table 5 shows that there are 149 (15.50%) gingival attachments, 777 (80.85%) mucosal

attachments, 29 (3.22%) papillary attachments, and 6 (0.62%) papillary penetrating attachments in females.

Table 5: Correlation between age groups and lower labial frenum attachment categories in females

Age group (year)	Lower labial frenum attachment in females				<i>p</i> -value
	Gingival	Mucosal	Papillary	Papillary penetrating	
10-30	86(15.72)	433(79.16)	23(4.20)	5(0.91)	0.213
31-50	46(15.08)	254(83.28)	4(1.31)	1(0.33)	
51-70	17(15.60)	90(82.57)	2(1.83)	0(0)	
Total	149(15.50)	777(80.85)	29(3.02)	6(0.62)	

The total number of upper labial frenum attachments in males and females is gingival 985 (50.80%), mucosal

359 (18.52%), papillary 498 (25.68%), and papillary penetrating 97 (5%), as shown in Table 6.

Table 6: Correlation between gender (Males and Females) and categories of upper labial frenum attachment

Gender	Total (male and female) upper labial frenum attachment				p-value
	Gingival	Mucosal	Papillary	Papillary penetrating	
Male	482(49.28)	209(21.37)	244(24.95)	43(4.40)	0.0096
Female	503(52.34)	150(15.61)	254(26.43)	54(5.62)	
Total	985(50.80)	359(18.52)	498(25.68)	97(5)	

As shown in Table 7, there are a total of 412 gingival attachments (21.25%), 1434 mucosal attachments (73.96%), 69 papillary attachments (3.56%), and 24

papillary penetrating attachments (1.24%) in both males and females.

Table 7: Correlation between lower labial frenum attachment categories and gender

Gender	Categories of lower labial frenum attachment				p-value
	Gingival	Mucosal	Papillary	Papillary penetrating	
Males	263(26.89)	657(67.18)	40(4.09)	18(1.84)	<0.0001
Female	149(15.50)	777(80.85)	29(3.02)	6(0.62)	
Total	412(21.25)	1434(73.96)	69(3.56)	24(1.24)	

As shown in Table 8, there are a total of 1397 gingival attachments (36.02%) on males and females, 1793 mucosal attachments (46.24%), 567 papillary

attachments (14.62%), and 121 papillary penetrating attachments (3.12%).

Table 8: Correlation between categories of upper and lower labial frenum attachment and gender

Gender	Total (male and female) upper and lower frenum attachment				p-value
	Gingival	Mucosal	Papillary	Papillary penetrating	
Males	745(38.09)	866(44.27)	284(14.52)	61(3.12)	0.046
Females	652 (33.92)	927(48.23)	283(14.72)	60(3.12)	
Total	1397(36.02)	1793(46.24)	567(14.62)	121 (3.12)	

In males, this study found a significant correlation between different upper labial frenal attachment categories and age groups (refer to Table 2). Additionally, there was a significant correlation between lower labial frenal attachment categories and age groups (refer to Table 3). In females, there was a significant correlation between the categories of upper labial frenum attachment and age groups, as shown in Table 4. Table 5 indicates no significant correlation between age groups and categories of lower labial frenum attachment. Furthermore, there was a significant correlation between gender (males and females) and categories of upper labial frenum attachment, reflected in Table 6. Similarly, there was a significant correlation between gender (males and females) and categories of lower labial frenum attachment, as demonstrated in Table 7. Finally, Table 8 demonstrates a significant correlation between gender (total males and females) and categories of both upper and lower labial frenum attachment.

DISCUSSION

In the labial and lingual areas, the frenum is a fibrous collagenous band that connects the lips to the gingiva, alveolar mucosa, and subperiosteum [19]. It is part of the mucosal membrane. Different places within the mouth contain frenal attachment. According to a generally accepted classification [3], there are four types of frenal attachment: mucosal, gingival, papillary, and papillary penetrating. This study examines males and

females' attachment of the upper and lower labial frenum. Males' upper labial frenum attachments are as follows: Gingival make up 482 (49.28%) of the total; mucosal account for 209 (21.37%); papillary make up 244 (24.95%); and papillary penetrating account for 43 (4.40%) of the total. Males classify the lower labial frenum attachments as gingival, while 657 (67.18%) are mucosal, 40 (4.09%) are papillary, and 18 (1.84%) are papillary penetrating. The findings of this study align with the results of the traditional study by Mirko *et al.* [3], which demonstrated that the maxilla had a gingival attachment of 46.5% and a mucosal attachment of 34.3%. In contrast, the mandible mostly had a mucosal attachment of 92.1%. Furthermore, our findings were consistent with the results of these studies [24,13,20,2]. According to this study, the total number of types of frenum attachment in the sample is as follows: gingival 1397 (36.02%), mucosal 1793 (46.24%), papillary 567 (14.62%), and papillary penetrating 121 (3.12%). This current results agreed with the observations reported by Christabel (2017) and Mendhe *et al.* (2023) [22,21]. This study discovered a significant relationship between the types of upper and lower labial frenum attachment and age groups in both males and females. Additionally, it revealed an important association between gender (males and females) and groups of upper and lower labial frenum attachments. Lastly, a noteworthy relationship was also found between gender (collectively males and females) and the types of upper and lower labial frenum attachment. These results are consistent with the findings of previous studies [3,2].

The results of this study contradicted the findings of those reported by others, which all claimed that there were no obvious gender-dependent differences in frenum attachments [23,22,12,14]. Therefore, we can infer that we did not detect any significant gender-related variances in a clinical context. Numerous factors, including dissimilarities in sample size, standards for insertion and elimination, the ethnic heterogeneity of the contributors, age clusters under study, and the skill of the examiners in their valuations, can account for the discrepancy in the occurrence of frenum attachments detected in several studies [2].

Conclusion

In both the maxilla and mandible, there is a significant difference in the attachment of the labial frenum. The maxilla had a higher incidence of gingival frenal attachment; on the other hand, the mandible had a higher frequency of mucosal frenal attachment. The study likewise revealed a remarkable association between frenum attachment age and gender. Frequently, dentists neglect the frenum during oral examinations. Therefore, it is crucial to conduct detailed clinical examinations and accurately assess the condition of the frenum during even clinical exercises, as this could potentially reduce the frequency of periodontal issues associated with the excessively high attachment of the frenum.

Conflict of interests

No conflict of interests was declared by the author.

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Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

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