Tooth Wear and Lower Incisor Crowding

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بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ

صدق الله العلي العظيم

سورة المجادلة آية ١١

الاهداء

" بسم خَالقي ومُيسر أموري وعصِمتُ امري ، لك كُل الحمد والامتنان"

الحمد لله حُباً وشكراً وامتناناً على البدء والختام...

﴿وَآخِرُ دَعْوَاهُمْ أَنِ الْحَمْدُ لِلَّهِ رَبِّ الْعَالَمِينَ﴾

لم تكن الرحلة قصيرة ولا ينبغي لها ان تكون , لم يكن الحلم قريبا ولا الطريق كان محفوفا بالتسهيلات لكني فعلتها , وصلت رحلتي الجامعية إلى نهايتها بعد تعب ومشقة.. وها أنا اليوم أتوج لحظاتِ الاخيرة من بحث التخرج بكل همّة ونشاط.

أهدي هذا النجاح إلى نفسي الطموحة أولاً، إلى كل من سعى معي لإتمام هذه المسيرة دمتم لي سنداً لا عُمر له...

إلى من كان دعاؤها سر نجاحي، التي كانت لي السند، والداعم الأول (امي)...

إلى من احمل اسمه بكل فخر، إلى من استمدّ منه القوة (أبي)...

كل الامتنان والتقدير إلى مشرفي الأساسي (د. عصام الجوراني) الذي وجّهني طوال هذا البحث ولم يبخل علينا في النصح والإرشاد، وكل أساتذتي الذي لهم الدور الكبير في إنجاح مسيرتي التعليمية..

Introduction

O cclusion in a dental context, simply means the contact between teeth. More technically, it is the relationship between the maxillary (upper) and mandibular (lower) teeth when they approach each other, as occurs during chewing or at rest [1]

As the primary (baby) teeth begin to erupt at 6 months of age, the maxillary and mandibular teeth aim to occlude with one another. The erupting teeth are molded into position by the tongue, the cheeks and lips during development. Upper and lower primary teeth should be correctly occluding and aligned after 2 years whilst they are continuing to develop, with full root development complete at 3 years of age. Around a year after development of the teeth is complete, the jaws continue to grow which results in spacing between some of the teeth (diastema). This effect is greatest in the anterior (front) teeth and can be seen from around age 4 – 5 years. This spacing is important as it allows space for the permanent (adult) teeth to erupt into the correct occlusion, and without this spacing there is likely to be crowding of the permanent dentition. [2]

Malocclusion is a misalignment or incorrect relation between the teeth of the upper and lower dental arches when they approach each other as the jaws close. [3-4]

The malocclusion classification is based on the relationship of the mesiobuccal cusp of the maxillary first molar and the buccal groove of the mandibular first molar. If this molar relationship exists, then the teeth can align into normal occlusion. According to Angle, malocclusion is any deviation of the occlusion from the ideal. However, assessment for malocclusion should also take into account aesthetics and the impact on functionality. If these aspects are acceptable to the patient despite meeting the formal definition of malocclusion, then treatment may not be necessary. It is estimated that nearly 30% of the population have malocclusions that are categorized as severe and benefit from orthodontic treatment. [5]

Tooth surface loss or tooth wear is an irreversible loss of hard tooth structure caused by factors other than those responsible for dental caries. Tooth wear is observed clinically as attrition, abrasion, abfraction, and erosion. It may be associated with symptoms such as tooth hypersensitivity and function impairment, and may lead to change in the morphology of the affected tooth. However, it may also be asymptomatic, meaning the patient may not be aware of it. In this instance, the dentist is encouraged to make the patient aware of this issue. [6]

Tooth wear is the result of four processes: abrasion (wear produced by interaction between teeth and other materials), attrition (wear through tooth-tooth contact), abfraction and erosion (dissolution of hard tissue by acidic substances). A further process (abfraction) might potentiate wear by abrasion and/or erosion. Knowledge of these tooth wear processes, and their interactions is reviewed. Both clinical and experimental observations show that individual wear mechanisms rarely act alone but interact with each other. The most important interaction is the potentiation of abrasion by erosive damage to the dental hard tissues. Saliva can modulate erosive/abrasive tooth wear, especially through formation of pellicle, but cannot prevent it.[7]

As the tooth wear increase with age and in some time, there is a late lower incisor crowding, so this study aimed to investigated if there is a relation between tooth wear and lower incisor crowding.

The aim of the study

The aim of the study is to evaluate the relationship between tooth wear and late lower incisor crowding

Chapter 1
Review

Review

1.1 Crowding:

Crowding occurs where there is a discrepancy between the size of the teeth and the size of the arches. Crowding affect Approximately 60% of Caucasians. Both jaw size and tooth size are mainly genetically determined and appear to be reducing; however, environmental factors, for example premature deciduous tooth loss, can increase crowding. In evolutionary terms both jaw size and tooth size appear to be reducing. However, crowding is much more prevalent in modern populations than it was in prehistoric times. This may be due to the introduction of a less abrasive diet, so that less interproximal tooth wear occurs during the lifetime of an individual. Also, a change from a rural to an urban lifestyle can also apparently lead to an increase in crowding after about two generations. [8]

1.1.1 Classification of Crowding:

Considering the amount of space deficiency, crowding is divided into:[8]

• Mild crowding (<4mm)

• Moderate crowding (4-8mm)

• Severe crowding (>8mm)

Considering its etiology, crowding is divided into:

• **Primary crowding (hereditary):** crowding is determined genetically and is caused by disproportionately sized teeth and jaws. The malalignment of the anterior teeth is characteristic of this type of crowding.

• **Secondary crowding:** it is an acquired anomaly caused by mesial drift of the posterior teeth after premature loss of deciduous teeth in the lateral segments.

• **Tertiary crowding:** occurs between the ages of 18 and 20 primarily of the lower anterior teeth. It may be attributed to.

1.1.2 Incisor crowding

Incisal crowding has a significant effect on the appearance of the smile, in some cases, make it more difficult to keep the teeth clean. It is one of the most common reasons for patients to seek orthodontic treatment. In modern times the problem of incisor crowding may have increased, and this has been largely attributed to several factors:

(1) a gradual reduction in jaw size caused by modern day diets that require less jaw activity to break down food

(2) genetic mixing of populations which has resulted in a mismatch between jaw size and tooth size. In reality the evidence is inconclusive and both factors may play an important role.

The incisors may also become crowded with normal age changes. It is common to see patients who had perfect alignment in young adulthood to become gradually less well aligned with age. This has been termed "late incisor crowding". [9]

1.1.3 late incisor crowding

Crowding of the mandibular incisors is one of the most common problems encountered in the permanent dentition and lower incisor alignment is one of the most likely things to relapse after orthodontic treatment. Studies of untreated subjects followed from the mixed dentition into adulthood have shown a tendency for the width and length of the mandibular arch to decrease and for crowding of the anterior teeth to increase. Primary crowding refers to a discrepancy of tooth dimension and jaw size, mainly determined genetically. Secondary crowding is caused by environmental factors, including local space conditions in the dental arches and the position and function of the tongue, the lips and the buccal musculature. Tertiary crowding occurs during adolescence and post-adolescence with a predilection for the lower labial segment. [10]

Factors contributing to late lower incisor crowding may include:

• Mandibular growth rotations.

• Anterior component of occlusal force.

• Physiologic mesial drift.

• Soft tissue maturation.

• Degenerative periodontal changes allowing teeth to drift under light Pressures.

• Change in diet and lack of interproximal wear.

• Tooth size and shape.

• Tooth loss and drifting leading to changes in occlusal function.

• Mandibular third molars – presence and position.

In reality, all of these factors may contribute to the development of late lower incisor crowding but the contribution of developing third molars is regarded as being minimal as crowding can develop even in the absence of their development. The prophylactic removal of developing third molars is not recommended to prevent late lower incisor crowding.[10]

1.1.4 Clinical Features

1. Crowding may be present unilaterally or bilaterally in the dental arches.

2. Crowding may be localized or generalized.

3. There is often difficulty in maintenance of good oral hygiene due to inaccessibility of certain tooth surfaces in crowded areas to toothbrush.

4. Food impaction may occur.

5. Halitosis may be present

6. Gingivitis and periodontitis may occur [8]

1.1.5 Diagnosis

1. Clinical examination reveals the extent and location of crowding.

2. Model analysis is needed for determining the arch length and tooth material discrepancy.

3. Radiographic examination helps in evaluating any trauma, bony pathology and unerupted teeth. [8]

1.2 Tooth wear

Tooth wear (also termed non-carious tooth substance loss) refers to loss of tooth substance by means other than dental caries or dental trauma. can be classified as attrition, erosion and abrasion. Attrition is defined as the loss of enamel, dentin, or restoration by tooth-to-tooth contact. [11]

Usually starting at the incisal or occlusal surfaces. Tooth wear is a physiological process and is commonly seen as a normal part of aging. Advanced and excessive wear and tooth surface loss can be defined as pathological in nature, requiring intervention by a dental practitioner. The pathological wear of the tooth surface can be caused by bruxism, which is clenching and grinding of the teeth. If the attrition is severe, the enamel can be completely worn away leaving underlying dentin exposed, resulting in an increased risk of dental caries and dentin hypersensitivity. It is best to identify pathological attrition at an early stage to prevent unnecessary loss of tooth structure as enamel does not regenerate. [12]

1. 2.1 Measurement of tooth wear and tooth wear index

Measurement of tooth wear is difficult because some wear is normal throughout life, and no single index has been universally accepted. Studies that aimed to analyze dental wear initially focused on clinical evaluation of the lesions, through the estimation of their severity and then began to report the distribution of the lesions. Smith and Knight (1984) introduced the Tooth Wear Index. In this index all surfaces are examined except for the interproximal surfaces i.e. buccal, lingual, occlusal, and cervical and scored from 0-4. The modifications were proposed to fit with the World Health Organization standard, thus allowing application of the index in broad epidemiological surveys, The modifications made calibration easier and resulted in higher degrees of reproducibility, as the modified version of the tooth wear index does not differentiate the depth of

dentine involvement, as is the case for the original tooth wear index. In addition, the modified version includes a code for teeth that have been restored due to wear (code 4), and another code for teeth that cannot be assessed (code 9). [16]

1.2.3 Problems of wear can include:

The problems of wear can summarize:[17]

1. Loss of tooth anatomy: This results in loss of tooth characteristics including rounding or sharpening of incisal edges, loss of cusps and fracturing of teeth. Enamel of molar teeth may appear thin and flat. When in occlusion the teeth may appear the same height which is particularly apparent for anterior teeth.

2. Sensitivity or pain: Attrition may be entirely asymptomatic, or there may be dentin hypersensitivity secondary to loss of the enamel layer, or tenderness of the periodontal ligament caused by occlusal trauma.

3. Tooth discoloration: A yellow appearance of the tooth surface may be due to the enamel being worn away, exposing the darker yellower dentin layer underneath.

4. Altered occlusion due to decreasing vertical height, or occlusal vertical dimension.

5. Compromised periodontal support can result in tooth mobility and drifting of teeth.

6. Loss in posterior occlusal stability.

7. Mechanical failure of restorations.

1.2.4 The etiology of dental wear:

Its etiological factors are multifactorial, one of the most common causes of attrition is bruxism. Bruxism is the para-functional movement of the mandible, occurring during the day or night. It can be associated with presence of audible sound when clenching or grinding the teeth. This is usually reported by parents or partners if the grinding occurs during sleep. In some cases, dental erosion is also associated with severe dental attrition. Dental erosion is tooth surface loss caused by extrinsic or intrinsic forms of acid. Extrinsic erosion is due to a highly acidic diet, while intrinsic erosion is caused by

regurgitation of gastric acids. Erosion softens the dental hard tissues making them more susceptible to attrition. Thus, if erosion and bruxism both exist, surface loss due to attrition is faster. Severe attrition in young patients is usually associated with erosive factors in their diets. The different physiological processes of tooth wear (abrasion, attrition, and erosion) usually occur simultaneously and rarely work individually. Therefore, it is important to understand these tooth wear processes and their interactions to determine causes of tooth surface loss. Demineralization of the tooth surface due to acids can cause occlusal erosion as well as attrition. Wedge-shaped cervical lesions are commonly found in association with occlusal erosion and attrition. Tooth wear is typically seen in the elderly and can be referred to as a natural aging process. Attrition, abrasion, erosion or a combination of these factors are the main reasons for tooth wear in elderly people who retain their natural teeth. This tooth wear can be pathological or physiological. The number of teeth with incisal or occlusal wear increases with age. Attrition occurs in 1 in 3 adolescents. In addition to other occlusal factors, independent variables such as male gender, bruxism, and loss of molar occlusal contact, edge-to-edge relation of incisors, unilateral buccolingual cusp-to-cusp relation, and unemployment have been identified in affecting occlusal wear. Similarly, anterior cross-bite, unilateral posterior cross-bite, and anterior crowding have been found to be protective factors for high occlusal wear levels. [18_26]

1.3 Malocclusion and Tooth Wear

Malocclusion has been shown to play an important role in the onset of tooth wear; however, little has been written about the advantages of orthodontic therapy in patients with TW Although the association between orthodontic treatment and dental health has been studied previously, no studies have hitherto investigated whether the need for, or the receipt of, orthodontic treatment leads to differences in tooth wear in the long term. The orthodontist and restorative dentist can work together to improve occlusion and esthetics for adult orthodontic patients seeking restoration of worn or abraded teeth. All

malocclusions have been linked to TW, with variations in severity and location in the mouth. While TW in Class I occlusion is said to affect both jaws equally, maxillary teeth are supposedly affected most in Class II malocclusion, and mandibular teeth are affected most in Class III malocclusion. [27]

Cunha estimated the prevalence of tooth wear and found that Angle's class II was associated with higher tooth wear prevalence than class I. Children with posterior or anterior open bite had lower prevalence of wear than their counterparts. No associations were observed between tooth wear and orthodontic treatment, missing teeth, and race ⁄ ethnicity. [28]

Janson investigated the prevalence of tooth wear in adolescents with class II malocclusion, compared with those with normal occlusion, they reported that the normal occlusion group had statistically greater tooth wear on the palatal surfaces of the maxillary central incisors and the incisal surfaces of the maxillary canines than the corresponding surfaces in both class II malocclusion groups. The complete and half-cusp class II division 1 malocclusion groups had statistically greater tooth wear on the occlusal surfaces of the maxillary second premolar and first molar, the occlusal surfaces of the mandibular premolars, and the buccal surfaces of the mandibular posterior teeth compared with the normal occlusion group. The half-cusp class II division 1 malocclusion group had significantly greater tooth wear on the incisal surfaces of the mandibular incisors compared with the complete class II division 1 malocclusion group. [28]

Chapter 2

Material And Methods

Material And Methods

2.1 The sample:

The sample has been selected randomly from the students at Babylon university (college of medicine, college of dentistry and college of nursing) and some patients were selected randomly from the patients attended the orthodontic department and oral medicine department of dentistry college of Babylon University. Out of 200persons only 61 subjects were selected (18-35 years old) and divided into two groups:

1. Group one included 21 subjects with normal occlusion (13 males and 8 females).

2. Group two included 40 subjects with malocclusion (14 males and 26 females).

The non-crowded one, included Class I molar, canine and incisor relationship with crowding, spacing and/or midline discrepancy not exceeding 1mm. A second category, the crowded one, had Class I molar on occlusion and lower incisal crowding of 2 mm or more. [29]

2.2 The sample was taken in terms of the following criteria: -

1. The sample was all Iraqi Arab in origin.
2. No previous orthodontic treatment.
3. No extracted teeth up to the first molar (all the permanent teeth should be present except for third molars).
4. No parafunctional habits.
5. No temporomandibular joint problems.
6. patient completed growth.

2.3 Instruments:

The following instruments were used:

1. dental mirrors.
2. Dental chair.
3. Kidney dishes.

4. dental chair light.

5. Cotten wools.

6. Air drying.

2.4 Clinical examination:

Clinical examination was performed in the dental clinic (orthodontic department of dentistry college/Babylon University) under dental chair light with aid of dental mirror. Teeth were dried using cotton wools or air drying. the clinical examination included examination of attrition of teeth with class I molar relation and without any habit.

2.5 Assessment of tooth wear

The surfaces of all teeth in the mouth were scored according to tooth wear index by Smith and Knight. The modifications matched the World Health Organization standards, thus allowing application of the index in broad epidemiologic surveys for both of deciduous and permanent dentitions. The modifications made calibration easier because the modified tooth wear index does not differentiate the depth of dentin involvement, as does the original tooth wear index. In addition, the modified version includes a code for teeth that have been restored due to wear (code 4) and another code for teeth that cannot be assessed (code 9) table (2.1) [16].

The gathered data were statistically analyzed by utilizing Statistical Package for Social Sciences **(SPSS)** program. The tests used include descriptive analysis; minimum, maximum, mean, standard deviation and **Mann-Whitney test**.

Permanent teeth	Criteria	Description
0	Normal _ no evidence of wear	No loss of surface features
1	Incipient _ tooth wear into enamel	Loss of enamel giving a smooth glazed shiny appearance, dentine is not involved
2	Moderate tooth wear into dentine	Extensive loss of enamel with dentine involvement. Exposure of dentine
3	Severe _ tooth wear into pulp or secondary dentin.	Extensive loss of enamel and dentine with secondary dentine or pulp exposure
4	Restored _tooth wear leading to restoration	The tooth received restorative treatment due to tooth wear
9	Could not be assessed	Extensive caries, large restoration, fractured tooth and missing tooth,

Table 2.1 tooth wear scores

2.5.1 Criteria used for measurement of tooth wear.

Scores of teeth:

Score (0): normal surfaces of the teeth, there is no evidence of wear and no loss of surface features. Figer 2.1

Figure 2.1 score (0) tooth wear

Score (1): Incipient tooth wear into enamel and loss of enamel giving a smooth glazed shiny appearance, dentine is not involved. Figure 2.2

Figure 2.2: score (1) tooth wear

Score (2): moderate tooth wear into dentine, there is extensive loss of enamel with dentine involvement (exposure of dentine). Figure 2.3.

Figure 2.3: score (2) tooth wear

Score (3): Severe tooth wear into pulp or secondary dentin, there is extensive loss of enamel and dentine with secondary dentine or pulp exposure. Figure 2.4

Figure 2.4: score (3) tooth wear [30]

Score (4): Restored, tooth wear leading to restoration, the tooth received restorative. treatment due to tooth wear. Figure 2.5

Figure 2.5: score (4) tooth wear [31]

Chapter 3

Results

Results

The sample was Iraqi Arab in origin, 61 patients randomly selected divided in two groups, group one normal occlusion (**21**) male (*13*) and female (*8*), the group two include patients with lower incisal crowding (**40**) male (*14*) and female (*26*) table (3.1). In total, 366 dental surfaces were evaluated. Of these, 22.8 % had no dental wear (score 0), 75% had incipient lesions (score 1), 3 % had moderate lesions (score 2) and no severe lesions were found, figure (3.1).

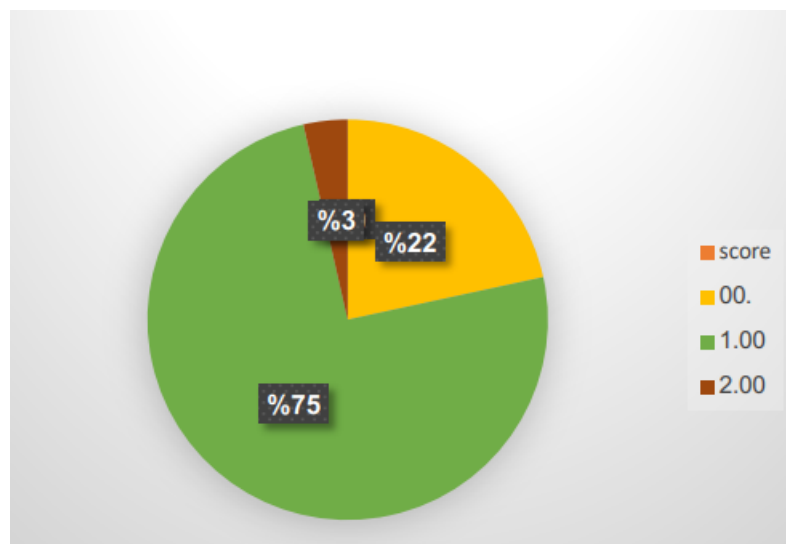| No. of sample		No. of scores
Normal occlusion (21)	Male (13)	78
	Female (8)	48
Lower crowding (40)	Male (14)	84
	Female (26)	156
total	61	366
Table 3.1 sample descriptions		

Figure 3.1percentages of tooth wear index scores.

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The group with normal occlusion had 126 scores, 34 score was 0, 86 score was 1 and only 6 score was 2, the other group with lower incisal crowding had 240 scores, 45 score was 0, 188 scores was 1 and only 7 scores was 2 table (3.1) and figure (3.2).
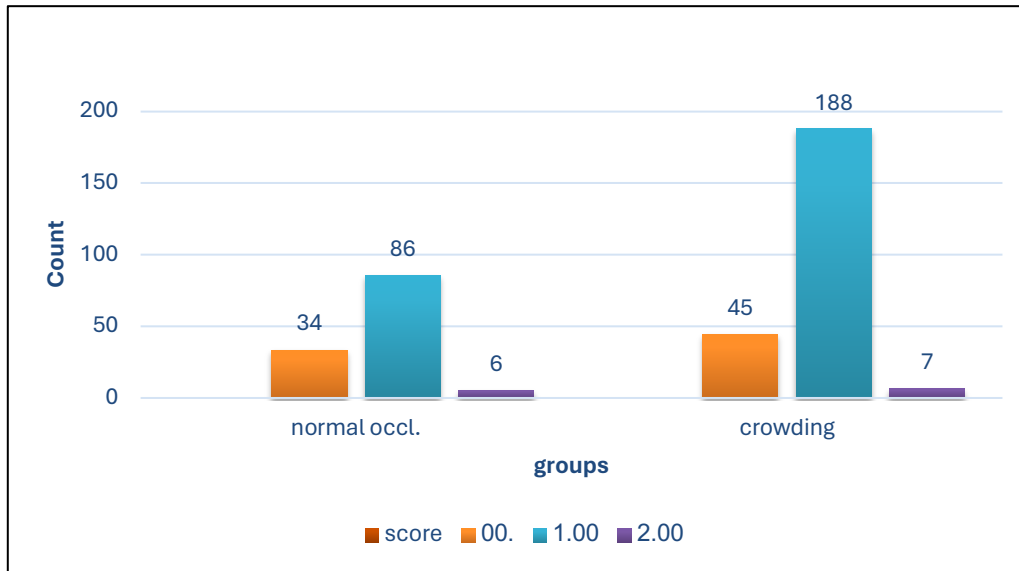

Figure 3.2 distribution of scores among normal occlusion and crowding

The distribution of scores among male and female in groups had been the following, the male in normal occlusion come with 20 scores was 0, 52 scores was 1 and 6 scores was 2. The female in normal occlusion come with 14 scores was 0, 34 scores was 1 and no scores was 2. The male in lower crowding occlusion come with 10 scores was 0, 73 scores was 1 and only 1 scores was 2. The female in lower crowding occlusion come with 35 scores was 0, 115 scores was 1 and only 6 scores was 2. figure (3.3).
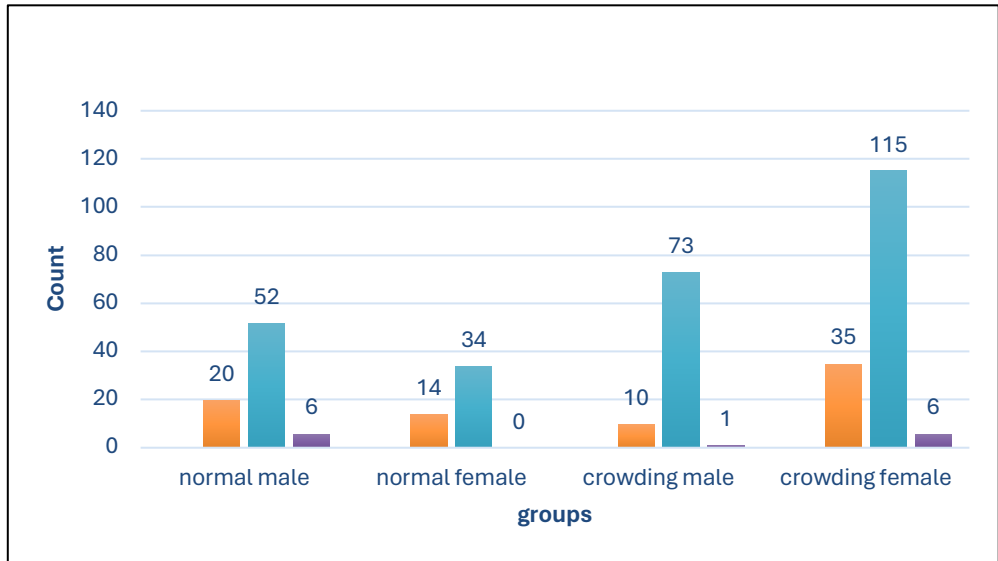
Figure 3.3 distribution of scores among male and female in

The lower incisal crowding group had mean of scores (0.8417) greater than mean of scores of normal occlusions (0.7778) but statically non-significant, P > 0.05 (table 3.2, 3.3).

sample	No. scores	Minimum	Maximum	Mean of scores	Std. Deviation
Normal occlusion	126	00	2.00	0.7778	0.51983
Lower crowding	240	00	2.00	0.8417	0.43863

Table 3.2 Descriptive Statistics of normal occlusion and malocclusion

groups	No. scores	Mean of scores	p. value
Normal occlusion	126	0.7778	0.176
Lower crowding	240	0.8417	

Table 3.3 tooth wear comparisons (normal occlusion and lower incisal crowding) (Mann-Whitney test).

The male and female subgroups show statical non-significant in all groups except between female in normal occlusion (0.7083) and male in lower crowding patients (0.8929) P < 0.05 table (3.4, 3.5).

sample		No. scores	Minimum	Maximum	Sum	Mean of scores	Std. Deviation
Normal occlusion	male	78	00	2.00	64.0	0.820	0.55229
	female	48	00	1.00	34.0	0.708	0.45934
Lower crowding	male	84	00	2.00	75.0	0.892	0.34772
	female	156	00	2.00	127.0	0.814	0.47931

Table 3.4 Descriptive Statistics of male and female in groups

	groups	No. scores	mean	p. value
1	Normal occlusion (male)	78	0.8205	*0.3*
	Normal occlusion (female)	48	0.7083	
2	Normal occlusion (male)	78	0.8205	*0.23*
	Lower crowding (male)	84	0.8929	
3	Normal occlusion (male)	78	0.8205	*0.9*
	Lower crowding (female)	156	0.8141	
4	Normal occlusion (female)	48	0.7083	*0.01**
	Lower crowding (male)	84	0.8929	
5	Normal occlusion (female)	48	0.7083	*0.2*
	Lower crowding (female)	156	0.8141	
6	Lower crowding (male)	84	0.8929	*0.15*
	Lower crowding (female)	156	0.8141	

Table 3.5 Intergroup tooth wear comparisons (Mann-Whitney test).

Chapter 4

Discussion

Discussion

Unfortunately, little has been written about malocclusion and tooth wear. Our study compared tooth wear between normal occlusion and patient with late lower incisal crowding, as the prevalence of crowding of one or more incisors was a common feature It was more common in the mandibular arch than the maxillary arch [32].

The study found differences in dental wear scores between the groups, with the lower incisal crowding group showing a slightly higher mean score. However, these differences were not statistically significant except for a specific comparison between female in normal occlusion and male in lower crowding patients.

The lower incisal crowding group had mean of scores greater than mean of scores of normal occlusions but statically non-significant, and this may be due to sample size, as this type of study need large sample.

The male and female subgroups show statical non-significant in all groups except between female in normal occlusion and male in lower crowding patients, and this may be due to gender difference together crowding can be led to increase in tooth lose structure (tooth wear).

Late lower incisal crowding can cause many problems to patients (esthetic, function

and in some conditions can increase tooth lose structures.

Conclusion

Teeth lose is a common problem in adults and this is due to many causes some of them mechanical (tooth wear) and some chemical (erosion). Incipient tooth wear has no problem, but progressive type can lead to sensitivity and lose of tooth structure. The crowding teeth causes many problems to the patients (esthetic and function) and can in some instances increase tooth wear and this enforce us to motivate the patients to correct crowding.

Chapter 5

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