

# PERIODONTAL EVALUATION OF AFID CADETS IN LOWER ANTERIOR CROWDING

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## ABSTRACT

*The objective of this study was to analyze the correlation between lower anterior teeth crowding and the periodontal status among cadets of Armed Forces Institute of Dentistry. The investigation of this relationship was done on 60 cadets. 30 subjects each represented the experimental and the control sample, with an age range between 19-24 years.*

*Plaque Index (PI) of lower six anterior teeth was used for assessment of periodontal status. Irregularity index (II) was used to calibrate the amount of lower anterior crowding. A number of statistical tests were performed to analyze the data.*

*The labial and lingual surfaces of teeth examined presented with plaque accumulation, that increased with the severity of lower anterior teeth crowding and was seen more lingually than labially. So a significant relation was observed between periodontal indices and lower anterior crowding ( $P - \text{value} < 0.001$ ).*

*On comparison between control group and experimental group, the labial and lingual surfaces of lower anterior teeth of control group showed less amount of plaque. Therefore a highly significant difference between the two group samples was present.*

*Thus, the present study showed that lower anterior teeth crowding has a deleterious effect on the periodontal health of the teeth when measured by plaque index.*

**Key words:** Lower anterior crowding, Periodontal disease Plaque Index (PI), Irregularity Index (II).

## INTRODUCTION

The goal of orthodontic treatment is to improve the patient's life adjustment by enhancing dental and jaw function and dentofacial esthetics. (Grabber 1994)<sup>1</sup>. It is important to realize that permanent dentition does not erupt into a static unchanging environment. Teeth in irregular alignment cause a crowding of the interproximate tissues with resultant reduced circulation and difficulty of cleansing. Whenever possible, orthodontic treatment must be employed to realign these teeth.

Much orthodontic therapy today can be termed as preventive periodontics. The periodontal reasons of orthodontic treatment are important for proper oral hygiene and for overall health of dentoalveolar structures. The gingival environment can be greatly improved when irregularities of anterior teeth are corrected. Orthodontist must take an active role in diagnosing periodontal problems, before initiating orthodontic treatment. If problems are discovered, then referral to a periodontist for detailed diagnosis and treatment planning is required. (Turpin 1994)<sup>2</sup>

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Correct tooth position is an important factor for proper function, for esthetics, and for overall preservation / restoration of dental health. Deviations in tooth morphology and position have profound effects on the attachment apparatus because occlusal prematurities, food impaction and other sequel will occur. If the angulation of any tooth is abnormal, its long axis is not parallel with the line of force of mastication. This may have a tendency to rock the tooth and exert excessive pressure to attachment apparatus, thus leading to its injury. The correlation between dental malalignment and periodontal problem is complex, with much apparently conflicting evidence and contradictory results.

Controversy is still going on over the issue on relationship between lower anterior crowding and periodontal diseases. However, this study was conducted to get an insight into the relationship of anterior crowding and periodontal status, in AFID cadets.

Unequivocal evidence that bacteria are specifically implicated in periodontal disease has come from studies carried out by different research workers. Loe et al in 1965<sup>6</sup> demonstrated 1st time experimentally that, gingivitis could be produced in any healthy individual by allowing microbial plaque to get accumulated, which resolved when oral hygiene measures were reinstated. Lindhe and co workers (1983)<sup>7</sup> later on reported that chronic periodontitis could be produced in experimental animals when plaque is allowed to accumulate for longer periods. It is now recognized that other local factors may play important roles in specific individuals (Kornman 2000)<sup>8</sup>

Periodontal disease is prevalent in most human populations and results in significant morbidity with premature tooth loss in severely affected individuals. Gingivitis is defined as inflammation of the marginal gingival tissues due to accumulation of dental plaque and is characterized clinically by redness, swelling and bleeding of the tissues. However, periodontitis is invariably associated with gingival inflammation and gingivitis appears to be a prerequisite for the development of periodontitis, although this is difficult to prove directly.

The inflammatory response to bacterial plaque at the dento-gingival junction is a fundamental defense mechanism against bacterial infection. However, both the inflammatory and immune responses involved have protective and destructive effects.

Orthodontic abnormalities, especially dental discrepancies, not only adversely affect the function and

phonation of the patient, but also adversely affect the aesthetics and periodontal health status of the patient. The impaction, impingement and retention of plaque and food may be encouraged by irregularities of tooth position or inclination. Overlapping, malposed, tilted or drilled teeth are frequently associated with food impaction and retention. A review of the dental effects of malocclusion indicated that role of dental malposition and periodontal disease was not clearly established (Griffith et al 1981)<sup>9</sup>

Some periodontal lesions have been attributed directly to malocclusions. The difficulty of cleaning irregular teeth may predispose to pathological conditions. Irregularity, particularly of the incisors, may expose teeth to the effects of trauma. Gingival recession with damage to the supporting alveolar bone is often seen when a lower incisor is displaced labially.

Traumatic occlusion may induce increased tooth mobility and angular bone resorption. But in healthy dentition, traumatic occlusion does not cause chronic gingivitis, apical shift of the dento-gingival. Epithelium, or increased bony pockets. In the presence of an ongoing destructive periodontitis, occlusal forces seem to accelerate the rate of progression of a plaque induced lesion. (Lindhe 1997)<sup>10</sup> If the malocclusion persists without any orthodontic intervention, this may deteriorate the periodontal condition, although, it was reported that the individual's motivation determines the oral health condition more than how well the teeth are aligned (Loe 1981)<sup>11</sup>

## MATERIALS AND METHODS

This is a case – control study. Cross – sectional data was recorded of the subjects. It was conducted at the Armed Forces Institute of Dentistry (AFID) in Rawalpindi, Pakistan. The commandant AFID granted

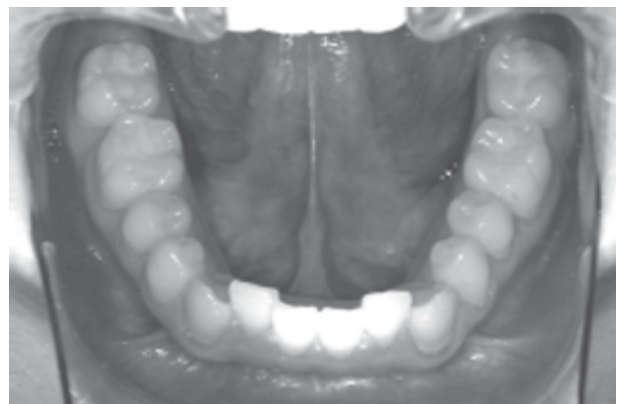


Fig. 1: Lower anterior crowding

the permission. AFID being one of the military health care institutes not only provides health care services to military personnel but is also a venue for academic training. Both military and civil students (male and female) are trained for a period of 4 years, after which they graduate as bachelors and pursue their careers as military or civil officers.

The cadets selected at AFID must come up to the following standards: Pakistani national; Intermediate pass; age group between 17 – 19 years, with neither a medically compromised condition nor a criminal record.

The grouping of cadets was done into two categories – the experimental group and the control group. The following criteria was kept in mind while grouping the cadets into the above mentioned categories:

Selection criteria for experimental group:

- i. Age b/w 18 –24 years
- ii. Presence of whole permanent dentition, with the exception of third molars
- iii. Lower anterior teeth with sound tooth structure
- iv. Medically fit and not on any drugs
- v. No history of orthodontic treatment
- vi. No history of recent periodontal treatment
- vii. Lower anterior teeth crowding (>1mm)

Selection criteria for control group:

- i. Presence of whole permanent dentition, with the exception of third molars
- ii. Good contacts between lower anterior teeth
- iii. Good alignment of lower anterior teeth
- iv. No / slight deviation from ideal arch form in lower anterior teeth
- v. No history of orthodontic / periodontal treatment

Exclusion criteria for both groups was the same and included the following:

- i. Below 18 years or above 24 years of age
- ii. Left handed individuals and individuals not practicing regular self oral hygiene procedures
- iii. Suffering from any syndrome or otherwise medically compromised

- iv. Smoker, betel nut chewer, diabetic, mouth breather or any other such factor that is generally regarded as detrimental to the periodontium
- v. Recently undergone professional plaque removal
- vi. h/o Orthodontic treatment

Cadets went through a meticulous visual screening. It was done to sort out the cadets on the basis of presence or absence of lower anterior crowding. The whole procedure was performed at AFID. The cadets were made to sit on a dental chair in a dental surgery. They were examined with mouth mirrors and disposable tongue depressors. Cadets with lower anterior crowding and conforming to the above mentioned standards were selected. In this way, a study sample at the end constituted of those cadets falling into both standards.

60 out of 125 cadets were filtered and then divided into:

1. Experimental group
2. Control group

Before carrying out the research work, the cadets were given a meticulous explanation of the work. Later they signed a written consent form (in english.) The clinical examination was carried out in a dental surgery, which involved the calibration of the plaque index. Documentation of the compilation was made in a special registration form. The next step was to take impressions for which fast setting alginate was used. Impressions along with bite wax of both the jaws were taken. Pouring of impressions was done with orthodontic plaster with a total expansion of 0.2%. A vacuum mixer was utilized for greater accuracy. Trimming of casts was done. Soaping of models affects the overall dimensions of the models, hence it was avoided.

For clinical examination, plain mouth mirror, explorer and complete (upper and lower) disposable impression trays were used. For case calibration, a manual caliper was used.

Both the labial and lingual surfaces of lower anterior teeth were used for calibration. The cadets were examined clinically for the plaque index (Annex 'A'). At the end, the figures were documented in a registration form. Calibration of the Irregularity index (Annex 'B') was done on the lower dental casts with the use of a manual caliper. The five measurements were summed up to compute the irregularity index.



Fig. 2: Casts from the control group



Fig. 3: Casts from the experimental group

## RESULTS

The mean age of the cadets included in the study was 21.36 years with a std deviation of 1.58.

Taking two measurements of the same subject by the same examiner at an interval of one week checked the intra – examiner reproducibility for the plaque



Fig. 4: A manual caliper

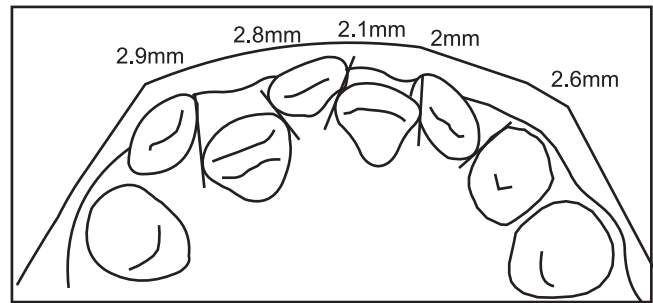


Fig. 5: Measurement of Irregularity Index

index. The results obtained had a high level of agreement, with a Kappa index of 0.82 for the lingual and 0.87 for the labial side.

The results of the statistical test used to check for random errors in the measurement of the irregularity index, yielded no significant difference between the two readings, taken by two different examiners ( $P > 0.075$ ).

**Lingual Side:** For the lingual side, the chi square test (performed at 5%) yielded a high correlation between the degree of crowding and plaque index with a  $P < 0.001$ .

**Labial Side:** For the labial side, the chi square test (performed at 5%) did not yield a very significant result.

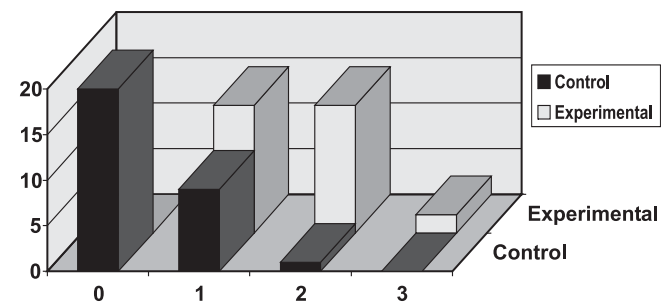


Fig. 6: Comparison of Plaque Indices on Lingual Side

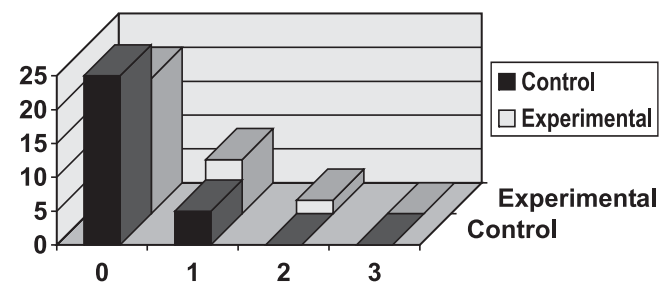


Fig. 7: Comparison of Plaque Indices on Labial Side

Crowding group	Control <1mm	Mild 1-4 mm	Moderate < X > 8 mm	Severe 4 > 8 mm	Total
No. of Subjects	30	2	22	6	60
%	50	3.3	36.67	10	100

TABLE 1: FREQUENCY DISTRIBUTION OF CROWDING

Irregularity Index	%	No of Surfaces	Plaque Index			
			0	1	2	3
Control	50.0	30	20	9	1	0
Mild (1-4 mm)	3.3	2	0	2	0	0
Moderate (4<X>8 mm)	36.67	22	0	12	10	0
Severe (>8 mm)	10.0	6	0	0	4	2
Total	100	60	20	23	15	2

TABLE 2: FREQUENCY DISTRIBUTION OF PLAQUE INDEX ON LINGUAL SIDE

Irregularity Index	%	No of Surfaces	Plaque Index			
			0	1	2	3
Control	50.0	30	25	5	0	0
Mild (1-4 mm)	3.3	2	2	0	0	0
Moderate (4<X>8 mm)	36.67	22	16	6	0	0
Severe (>8 mm)	10.0	6	2	2	2	0
Total	100	60	45	13	2	0

TABLE 3: FREQUENCY DISTRIBUTION OF PLAQUE INDEX ON LABIAL SIDE

TABLE 4: METHOD ERRORS

Statistical test	N	t	P - Value
Paired t - test	28	-0.067	0.735*

\* P &gt; 0.075 Not Significant.

TABLE 5: CORRELATION BETWEEN CROWDING AND PLAQUE INDEX ON LINGUAL SIDE

Parameter	X <sup>2</sup>	P
Value	17.17	<0.001*

\* Highly Significant

TABLE 6: CORRELATION BETWEEN CROWDING AND PLAQUE INDEX ON LABIAL SIDE

Parameter	X <sup>2</sup>	P
Value	3.26	<0.05*

\* Not Significant

TABLE 7: COMPARISON OF MEANS AND STANDARD DEVIATIONS

Crowding Group	Labial Surface			Lingual Surfaces		
	n	x	SD	n	x	SD
Control	30	0.1667	0.3790	30	0.3667	0.5561
Mild (1-4 mm)	2	0.00	0.00	2	1.00	0.00
Moderate (4<X>8 mm)	22	0.2727	0.4558	22	1.4545	0.5096
Severe (>8 mm)	6	1.00	0.8944	6	2.3333	0.5164

### PLAQUE INDEX IN EXPERIMENTAL VERSUS CONTROL GROUP

More plaque accumulation was evident in the experimental group as compared to control group.

### DISCUSSION

This study is cross sectional by nature. Ideally a longitudinal study should be carried out on the subjects, however due to ethical reasons, that may not be possible. The subjects were selected from within the profession to rule out the variability in awareness and education levels, as this has been shown to affect the quality of oral hygiene. (Addy et al 1988)<sup>18</sup> Only right handed individuals with no history of orthodontic / recent periodontal treatment and otherwise medically fit were selected to rule out some of the many etiologic factors of periodontal disease. The inclusion of only anterior teeth was done to rule out the differences caused by manual dexterity.

The Irregularity Index was calculated indirectly on patients cast. It should not be assumed that the direct measurements are necessarily more accurate than those obtained from plaster models.

In this study, Plaque index was used for assessment of patient's oral hygiene. It is one of the most commonly used index for the purpose (Silness and Loe, 1964)<sup>19</sup> Addy et al 1988<sup>18</sup>.) It was used to assess the correlation between the degree of lower anterior crowding and periodontal status, as done by Ainamo (1972)<sup>20</sup>, Ingervall (1977)<sup>21</sup>, Buckley (1980)<sup>22</sup>, Hashim (1990)<sup>16</sup>, Al Jasser (1993)<sup>17</sup>, Ashley et al (1998)<sup>14</sup>, Al Humayani (1998)<sup>23</sup>.

No association between Angles classification of malocclusion and periodontal status is seen in the study of Ditto and Hall 1954<sup>24</sup>. However, Miller and Hobson 1961<sup>25</sup> found those with Angle class I, II, & III malocclusions had a poor gingival condition than those with normal occlusion.

Alexander and Tipins (1970)<sup>26</sup> studied the effect of irregularity of teeth on the gingival health in two adult groups where one group comprised of 200 British school children, while the other group consisted of 200 patients attending the dental hospital. They found a significant association between gingival inflammation scores and irregularity of teeth in the hospital patients. The relation was not so evident in the school children. Buckley (1980)<sup>22</sup> on examination of 300 subjects found that there was a low but significant correlation between irregular teeth, plaque and gingival disease in female but not in male subjects. Silness and Roynstrand (1985)<sup>15</sup> on studying 74 female and 70 male subjects, concluded that anterior tooth segments with no or few non – aligned teeth had a more favorable periodontal status than segments with a lot of non – aligned teeth. Al Jasser (1993)<sup>17</sup> found a significant association between calculus index, periodontal index, bleeding index and the irregularity of teeth, on the examination of 150 Saudi male subjects, aged 20 to 30 years. Landmesser (2004)<sup>27</sup> examined 125 adult subjects (63 women, 62 men) and concluded that crowding > 3mm was an individual “host factor” for chronic inflammatory processes. Ngom et al (2006)<sup>28</sup> studied 101 young adults, aged 20 to 35 years, who were all students or teachers of the Department of Dentistry, Faculty of Medicine, Pharmacy and Dentistry at University Cheikh Anta

Diop of Dakar, Senegal. They found a significant relationship between the intra arch irregularity of teeth and the amount of plaque accumulation.

However, the findings of Ingervall's (1977)<sup>21</sup> clinical trial on 50 dental students failed to show any association between periodontal health and tooth irregularity. Behlfelt et al (1981)<sup>29</sup> found tooth malalignment to be only of secondary importance in the progression of periodontal disease. No significant effect of mandibular anterior crowding was found in a longitudinal follow – up study of 20 years by Helm & Peterson (1989)<sup>30</sup>. Ashley et al (1998)<sup>14</sup> in a study of 201 schoolchildren, aged 11 – 14 years did not observe any association between incisor irregularity and the amount of plaque. Artun & Osterberg (1998)<sup>31</sup> studied 400 dental casts taken at least 10 years after retention and measured their irregularity index. Of the treated patients, they clinically examined only 34 subjects and found only minor differences in periodontal status between crowded and aligned lower incisors in patients with good oral hygiene. Geiger A.M. (2001)<sup>12</sup> recently wondered about the available findings on the correlation between malocclusion and periodontal disease and emphasized the need for additional qualitative studies to validate the predictability of malocclusion as an etiologic factor of periodontal disease.

In the current study a highly significant correlation was demonstrated between irregularity index and plaque index. It appears that despite similar oral hygiene regimens, the degree of irregularity of teeth, affected the level of oral hygiene and plaque removal attained. This was more so the case on the lingual side than on the labial side.

## CONCLUSIONS

- A highly significant relationship was found between the degree of malocclusion in the lower anterior segment and the amount of plaque accumulation.
- The degree of plaque accumulation was more evident on the lingual side than on the labial side.
- Both the labial and lingual surfaces of the control group demonstrated significantly less plaque accumulation than the corresponding surfaces of the experimental group.

A similar study should be conducted at a national level to evaluate the correlation of lower anterior crowding and periodontal health.

## ANNEXURE 'A'

### o Plaque Index:

Score 0 – No plaque

Score 1 – Thin film / slight plaque accumulated to the edges of gums and teeth, when scraped with an explorer.

Score 2 – Moderate accumulation of soft deposits in the pocket depths / tooth surfaces / gums, when seen with naked eye.

Score 3 – Massive amounts of soft matter in pocket depths / tooth surfaces / gums / contact points.

## ANNEXURE 'B'

### 2.4.3 IRREGULARITY INDEX:-

*Year of establishment:* 1975

*Type of procedure:* Clinical index

*Developer:* RM Little<sup>32</sup>

*Purpose:* To assess anterior mandibular malocclusion (crowding)

*Background Information:* -

This method is used by determining the linear displacement of adjacent Anatomic contact points of six mandibular anteriors (the centrals, laterals, and cuspids) This index is considered as a simple, clinically reliable, valid index.

*Drawbacks:* -

- It has the tendency to exaggerate casts with considerable irregularity but with little arch length shortage
- The index does not allow for several factors that must be considered when assessing and formulating a comprehensive diagnosis such as subject's cephalometric pattern, facial esthetics, age, tooth morphology and effect of habit correction.

*Procedure of Method:* -

- This index is determined by measuring from subject's mandibular cast

- The examiner uses a caliper, calibrated to at least the nearest tenth of a millimeter, which is held parallel to the occlusal plane to measure.
- The linear displacement of adjacent anatomic contact points of six mandibular anterior incisors is measured.
- The five measurements are summed up to compute the irregularity value index.

#### Modifications:-

For the National health and nutrition examination survey (NHANES) III, 1988-1994, the index was used as a basis for incisor alignment procedures. Unlike the I. Index developed by Little, the NHANES III incisor alignment procedure measures the linear displacement of anatomic contact points in both the jaws.

This incisor alignment procedure was included as a component of Treatment priority index.

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