*Original Article*

# Intraarch and Interarch Relationships of the Anterior Teeth and Periodontal Conditions

**Papa Ibrahima Ngom[a]; Falou Diagne[b]; Henri Michel Benoist[c]; Fana Thiam[d]**



**ABSTRACT**

This study was undertaken to investigate the association between orthodontic anomalies and periodontal conditions. Three parameters of the intraarch relationship on both dental arches (displacement of contact point, crowding, and spacing) and four parameters of interarch relationship (overjet, open bite, crossbite, and overbite) assessed with either Index of Orthodontic Treatment Need or Index of Complexity, Outcome and Need were correlated with parameters of periodontal condition, ie, hygiene (Plaque Index and Retention Index), inflammation (gingival inflammation and Gingival Bleeding Index), and periodontal disease severity (pocket depth, clinical attachment loss, and gingival recession). In the main, weak but significant correlations were found between certain parameters of intraarch and interarch relationship and some indices of periodontal conditions. Within the limitations of this study, it was concluded that providing orthodontic treatment on the ground of deleterious effect of malocclusion and malpositioned teeth on periodontal condition is justified. (*Angle Orthod* 2006;76:236–242.)

**KEY WORDS:** Intraarch relationship; Interarch relationship; Periodontal condition; Orthodontic indices; Periodontal indices

## INTRODUCTION

The past decades have witnessed a steady increase of children and adults undergoing orthodontic treatment in industrialized countries.[1] The same trend might be observed in developing countries. Improvement of facial and dental esthetics and of dental health and function are routinely cited to justify the provision of orthodontic treatment and form the cornerstone of some orthodontic indices. The Index of Orthodontic Treatment Need (IOTN)[2] records treatment need on the basis of two components, a Dental Health Component (DHC) and an Aesthetic Component. The DHC intends to record the indication for treatment on the ground of potential deleterious effects of malocclusion on the health and functioning of the dentition. At the time of its development, the authors pointed out the uncertainty about the relative contribution that each occlusal trait makes to the health of the dentition and emphasized the adaptability of the index according to the emergence of further research findings on this area.[2] The Index of Complexity, Outcome and Need (ICON) was developed later and is based on the consensus opinion of eight European countries and the United States.[3]

The etiology and pathogenesis of periodontal disease are known to be multifactorial, but dental plaque is recognized as an essential precursor.[4,5] Hence, any factor presumed to promote plaque retention or to make difficult its removal might contribute to the local risk of periodontal disease. For instance, crowding of teeth creates areas hardly accessible to tooth brushing and has been recognized to make a thorough cleaning of the teeth laborious.[6–8] Various types of malocclusions have also been correlated to increased plaque indices.[9,10] On the other hand, many investigations failed to demonstrate any significant correlation between tooth irregularities and periodontal state.[11] In

[a] Assistant Professor, Orthodontic Section, Department of Dentistry, Faculty of Medicine, Pharmacy and Dentistry, Université Cheikh Anta Diop, Dakar, Senegal.

[b] Assistant Professor, Orthodontic Section, Department of Dentistry, Faculty of Medicine, Pharmacy and Dentistry, Université Cheikh Anta Diop, Dakar, Senegal.

[c] Assistant Professor, Section of Periodontics, Department of Dentistry, Faculty of Medicine, Pharmacy and Dentistry, Université Cheikh Anta Diop, Dakar, Senegal.

[d] Postgraduate student, Faculty of Medicine, Pharmacy and Dentistry, Université Cheikh Anta Diop, Dakar, Senegal.

Corresponding author: Papa Ibrahima Ngom, Department of Dentistry, Faculty of Medicine, Pharmacy and Dentistry, Université Cheikh Anta Diop, BP 45282 Dakar, Senegal (e-mail: ibrahim@refer.sn, e-mail: ngomibrahim@hotmail.com)

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**TABLE 1.** Scoring System for the Intraarch Relationship With IOTN and ICON[a]

| Scores | IOTN CPD | ICON | |
|---|---|---|---|
| | | Crowding | Spacing |
| 0 | No CPD | <2 mm | <2 mm |
| 1 | 1 mm ≥ CPD > 0 mm | 2.1 to 5 mm | 2.1 to 5 mm |
| 2 | 2 mm ≥ CPD > 1 mm | 5.1 to 9 mm | 5.1 to 9 mm |
| 3 | 4 mm ≥ CPD > 2 mm | 9.1 to 13 mm | 9.1 to 13 mm |
| 4 | >4 mm | 13.1 to 17 mm | |
| 5 | | >17 mm | |

[a] IOTN indicates Index of Orthodontic Treatment Need; ICON, Index of Complexity, Outcome and Need; CPD, Contact Point Displacement.

addition, some authors stressed that the enhancement provided by orthodontic treatment in terms of periodontal health may be of minor importance compared with maintenance of good oral hygiene.[12] Also, recently, Geiger[13] wondered about the available findings on the correlation between malocclusion and periodontal disease and emphasized the need for additional quantitative studies to validate the predictability of malocclusion as an etiologic factor of periodontal disease.

Toward these ends, this study was undertaken to further investigate the correlation between the intraarch and interarch relationships of the anterior teeth as assessed by the IOTN and the ICON and some parameters of periodontal conditions, ie, hygiene, inflammation, disease severity, and treatment need.

## MATERIALS AND METHODS

### Subjects

The study population consisted of a sample of 101 young adults (51 males and 50 females), aged 20 to 35 years (mean 25.44 ± SD 3.00 years) with no history of orthodontic treatment. They were students or teachers of the Department of Dentistry, Faculty of Medicine, Pharmacy and Dentistry at University Cheikh Anta Diop of Dakar (Senegal). They participated in the study on a voluntary basis after receiving comprehensive information about the aims and design of the study before its start and signed an informed consent. Before enrollment in the study, information regarding oral hygiene habits and knowledge about oral hygiene practice were obtained directly from each subject.

### Inclusion criteria

To be included in the study, subjects needed to fulfill the following criteria: possession of the six natural teeth of the anterior sextant (incisors and canines) in each arch; manual tooth brushing at least twice daily—right handed; and thorough knowledge of useful oral hygiene methods.

### Noninclusion criteria

These included known factors likely to influence periodontal condition, ie, smoking, pregnancy, mouth breathing, and diabetes. In addition, all subjects who had undergone professional plaque removal and scaling in the past five months were not included in the study.

### Assessment of periodontal condition

The study subjects were examined for evaluation of periodontal conditions in a dental office under optimal conditions with a mouth mirror and a periodontal probe. Parameters related to the periodontal status were assessed directly by one of the authors in the upper and lower anterior sextant (incisors and canines of both the maxillary and the mandibular arches). These included oral hygiene, gingival inflammation, and severity of periodontal disease.

*Oral hygiene.* The oral hygiene status was evaluated by measuring the amount of soft and mineralized deposits present on the tooth surface. Plaque and calculus were assessed on all four surfaces (labial, lingual/palatal, mesial, and distal) of incisors and canines in both the lower and upper arches by the Plaque Index (PlI) and the Retention Index (RI).[14]

The PlI and RI were recorded as described by Loe[14] except that for RI only calculus was taken into account. Cavities and dental restorations were not considered. The plaque and retention scores from the four areas of each tooth were added and divided by four to give the PI and the RI for the tooth. The PII and the RI for the anterior sextant of each arch were obtained by summing the scores for individual teeth (incisors and canines) and divided by six (the number of teeth in each sextant).

*Gingival inflammation.* The degree of gingival inflammation was assessed with the Gingival Index (GI)[14] and the Gingival Bleeding Index (GBI).[15] For the GI,[14] each of the four gingival areas of the teeth (labial, lingual/palatal, mesial, and distal) is given a score from 0 to 3, which represent the GI for the area. The scores from the four areas of the tooth were added and divided by four to give the GI for the tooth. The scores for individual teeth of each arch were summed and divided by six to obtain the GI for the anterior sextant.

The GBI[15] is recorded dichotomously after a gentle probing of the mesial, midline, and distal on the labial and lingual/palatal surfaces of each of the targeted teeth. GBI = 0 corresponds to an absence of bleeding and 1 to presence of bleeding, 15 seconds after the removal of the probe. The GBI for each tooth is cal-

**TABLE 2.** Scoring System for the Interarch Relationship With IOTN and ICON[a]

| | Crossbite | | Overbite | |
|---|---|---|---|---|
| Scores | IOTN | ICON | IOTN | ICON |
| 0 | | No crossbite | | |
| 1 | | Crossbite present | | Overbite < 1/3 |
| 2 | Discrepancy[b] <1 mm | | >3.5 mm | 1/3 to 2/3 coverage[c] |
| 3 | 2 mm < Discrepancy[b] >1 mm | | Full coverage[c] | 2/3 < coverage[c] < 3/3 |
| 4 | Discrepancy[b] >2 mm | | Full coverage[c] + GP trauma | Full coverage[c] |
| 5 | | | | |

[a] IOTN indicates Index of Orthodontic Treatment Need; ICON, Index of Complexity, Outcome and Need.
[b] Discrepancy between retruded contact point and intercuspal position.
[c] Lower incisor coverage.

culated by summing the scores for the six areas and by dividing it by six. The GBI for the sextant is calculated by dividing the score of the teeth by six.

*Disease severity.* The extent of periodontal disease severity was assessed by measuring the pocket depth (PD), the clinical attachment loss (CAL), and the gingival recession (GR) with a William probe on six areas of the teeth of the upper and lower anterior sextant, ie, mesial, midline, and distal on the facial and lingual/palatal surfaces. The score for the sextant is obtained by averaging the findings for the six teeth.

### Intraarch and interarch relationship parameters

The intraarch and interarch relationship was assessed on the anterior sextant (teeth 13 to 23 and 33 to 43) by either IOTN[2] or ICON[3] (or both) depending on the occlusal traits of interest. The recording of the IOTN and ICON scores was performed with a disposable IOTN DHC ruler and an ordinary millimeter ruler by one of the authors, who was trained, and calibrated in the use of these occlusal indices. Scoring protocols for IOTN and ICON are given in Tables 1 and 2.

The extent of the reliability of the assessment of the periodontal condition and the intraarch/interarch relationship was assessed by performing the same assessment on a random subsample of 20 subjects with a minimum interval of one month.

### Statistical analysis

The set of variables used in this study are summarized in Table 3. Wilcoxon matched pairs signed rank test and kappa statistics were used to test the reliability of the assessment of periodontal condition and intraarch and interarch relationship, respectively. Differences between males and females with respect to periodontal condition score were tested with Mann-Whitney *U*-test. Spearman rank correlation was used to test the association between the periodontal condition and the intraarch and the interarch relationship.

All tests were carried out by SPSS (Release 11, 2001, Chicago, Ill). Significance was set at the 5% level.

## RESULTS

None of the tests for reliability using Wilcoxon matched pairs test were significant at the 5% level. Kappa statistics was, respectively, 0.87 and 0.91 for the assessment of intraarch and interarch relation with the IOTN and the ICON.

The periodontal status of the male and female subjects along with the corresponding interpretation is shown in Table 4. Overall, it appears that the study subjects had average periodontal conditions. Females generally had better periodontal condition than males, but the difference was significant only for the RI, which takes into account only the amount of calculus present on the tooth surface.

About one third of the subjects have at least some kind of orthodontic anomaly. Tables 5 and 6 show the distribution of the different features of the intraarch and the interarch relationship as assessed by IOTN and ICON.

Correlations between parameters of periodontal condition and intraarch relationship in the maxilla and the mandible are listed in Table 7. Weak but significant correlations were found between contact point displacement and the PII and the GI in both the maxilla and the mandible.

Crowding is significantly correlated with almost all parameters of periodontal condition in the mandibular arch but not in the maxillary arch. Overall, spacing is negatively correlated to periodontal condition, but this correlation is not significant. The periodontal disease severity, as reflected by PD, clinical attachment loss, and GR, is not significantly correlated with the parameters of intraarch relationship except with crowding of teeth.

Table 8 shows the correlations between the interarch relationship and the periodontal status. Open bite assessed by either the IOTN or the ICON is often positively and significantly correlated with the parameters of periodontal condition. The only exception is with GR with which it is negatively correlated. The parameters

**TABLE 2.** Extended

| Open Bite | | Overjet |
|---|---|---|
| IOTN | ICON | IOTN |
| 1 mm ≥ OB > 0 mm | <1 mm | 6 mm ≥ OJ > 3.5 mm |
| 2 mm ≥ OB > 1 mm | 2 mm ≥ OB > 1.1 mm | 6 mm ≥ OJ > 3.5 mm |
| 4 mm ≥ OB > 2 mm | 4 mm ≥ OB > 2.1 mm | 9 mm ≥ OJ > 6 mm |
| OB > 4 mm | >4 mm | >9 mm |

**TABLE 3.** Summary of the Variables Used[a]

| | Variables | Type of Variable | Unit |
|---|---|---|---|
| Periodontal condition | | | |
| Hygiene | PII | Ordinal | Unitless |
| | RI | Ordinal | Unitless |
| Gingival inflammation | GI | Ordinal | Unitless |
| | GBI | Ordinal | Unitless |
| Periodontal disease severity | PD | Scale | mm |
| | CAL | Scale | mm |
| | GR | Scale | mm |
| Intraarch and interarch relationship | | | |
| Intraarch relationship | CPD | Ordinal | mm |
| | Spacing | Ordinal | mm |
| | Crowding | Ordinal | mm |
| Interarch relationship | Crossbite ICON | Ordinal | mm |
| | Open bite ICON | Ordinal | mm |
| | Overbite ICON | Ordinal | mm |
| | Overjet IOTN | Ordinal | mm |
| | Crossbite IOTN | Ordinal | mm |
| | Overbite IOTN | Ordinal | mm |
| | Open bite IOTN | Ordinal | mm |
| Demographic data | Age | Scale | Years |
| | Gender | Nominal | Unitless |

[a] PII indicates Plaque Index; RI, Retention Index; GI, Gingival Index; GBI, Gingival Bleeding Index; PD, pocket depth; CAL = clinical attachment loss; GR, gingival recession; CPD, contact point displacement; IOCN, Index of Complexity, Outcome and Need; IOTN, Index of Orthodontic Treatment Need.

of disease severity are generally significantly correlated with those of interarch relationship (Table 8).

## DISCUSSION

### Methodological considerations and limitations of this study

This study is cross-sectional and observational by nature. At best, the scope of such a study is limited to demonstrating a correlation between exposition and presence or absence of a disease or a condition. Hence, on the basis of the present findings, one cannot speculate about a causal relationship between orthodontic anomalies and periodontal condition. Because of the multifactorial nature of periodontal disease, longitudinal studies controlling for most confounding effects are necessary. However, it should be borne in mind that, with respect to the current subject matter, longitudinal studies may be probably highly unethical and methodologically difficult to carry out. Accordingly, this study and its predecessors can provide valuable indications on the influence of orthodontic anomalies on periodontal condition.

Evidence exists to suggest a close relationship between educational level and quality of oral hygiene.[16] A poor dental attendance pattern has also been found to be associated with a higher frequency of periodontitis.[17] These findings dictated the choice of the study population within the dental profession. It is assumed that the study subjects have the necessary skills and motivation to remove supragingival plaque and subsequently to prevent the onset of gingivitis. It addition, they may have the same level of awareness regarding these confounding factors. The restriction of the study to the anterior teeth proceeds also from the need to reduce the possible confounding effect of manual dexterity in tooth brushing. Also, the noninclusion of left-handed subjects, pregnant women, and smokers and

**TABLE 4.** Periodontal Status of the Subjects and Interpretation. Comparison Between Male and Female Subjects[a]

| Periodontal Condition | Male (Mean ± SD) | Male Interpretation | Female (Mean ± SD) | Female Interpretation | Mann-Whitney *U*-test *P* Value |
|---|---|---|---|---|---|
| Upper arch | | | | | |
| PII | 0.99 ± 0.53 | Average plaque control | 0.84 ± 0.40 | Average plaque control | .16 |
| RI | 0.20 ± 0.31 | Slight amount of calculus | 0.10 ± 0.29 | Slight amount of calculus | .00** |
| GI | 0.42 ± 0.44 | Mild gingival inflammation | 0.30 ± 0.36 | Mild gingival inflammation | .14 |
| GBI | 0.10 ± 0.18 | Mild gingival inflammation | 0.08 ± 0.12 | Mild gingival inflammation | .94 |
| CAL | 3.26 ± 1.48 | | 3.05 ± 0.92 | | .55 |
| PD | 3.12 ± 1.04 | Shallow pockets | 3.03 ± 0.84 | Shallow pockets | .77 |
| GR | 0.32 ± 1.34 | | 0.05 ± 0.42 | | .30 |
| PII | 1.22 ± 0.65 | Average plaque control | 0.99 ± 0.56 | Average plaque control | .09 |
| RI | 0.62 ± 0.71 | Slight amount of calculus | 0.40 ± 0.64 | Slight amount of calculus | .04* |
| Lower arch | | | | | |
| GI | 0.66 ± 0.56 | Mild gingival inflammation | 0.53 ± 0.61 | Mild gingival inflammation | .08 |
| GBI | 0.19 ± 0.27 | Mild gingival inflammation | 0.15 ± 0.22 | Mild gingival inflammation | .60 |
| CAL | 3.22 ± 1.09 | | 3.25 ± 1.05 | | .92 |
| PD | 2.98 ± 1.02 | Shallow pockets | 3.2 ± 1.03 | Shallow pockets | .53 |
| GR | 0.58 ± 1.26 | | 0.25 ± 0.89 | | .14 |

[a] PII indicates Plaque Index; RI, Retention Index.
** Difference significant at .001 level.

**TABLE 5.** Distribution of Features of the Intraarch Relationship Within the Study Subjects[a]

| | IOTN CPD (n = 101) | | | | | ICON Crowding (n = 101) | | | | | ICON Spacing (n = 101) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scores: | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 | 0 | 1 | 2 | 3 | 4 |
| Upper arch | 7 | 26 | 31 | 26 | 11 | 73 | 19 | 6 | 3 | 0 | 67 | 16 | 11 | 7 | 0 |
| Lower arch | 5 | 19 | 41 | 28 | 8 | 49 | 37 | 10 | 4 | 1 | 81 | 11 | 5 | 4 | 0 |

[a] IOTN indicates Index of Orthodontic Treatment Need; ICON, Index of Complexity, Outcome and Need; CPD, Contact point displacement.

**TABLE 6.** Distribution of Features of the Interarch Relationship Within the Study Subjects[a]

| | Crossbite | | Overbite | | Open bite | | Overjet |
|---|---|---|---|---|---|---|---|
| Value | IOTN (n = 101) | ICON (n = 101) | IOTN (n = 101) | ICON (n = 101) | IOTN (n = 101) | ICON (n = 101) | IOTN (n = 101) |
| 0 | 71 | 70 | 82 | 81 | 83 | 85 | 66 |
| 1 | 0 | 30 | 0 | 14 | 0 | 3 | 0 |
| 2 | 15 | | 18 | 6 | 8 | 4 | 22 |
| 3 | 6 | | 1 | | 5 | 4 | 6 |
| 4 | 9 | | 0 | | 5 | 5 | 7 |
| 5 | | | | | 0 | 0 | 0 |

[a] IOTN indicates Index of Orthodontic Treatment Need; ICON, Index of Complexity, Outcome and Need.

the inclusion of subjects of a relatively close age bracket, arises from the same concerns. However, these precautions have been taken at the expense of losing the possibility of generalizing the findings to other areas of the mouth and to other subgroups of population.

The subjects included in this study have claimed to brush their teeth at least twice daily and to attend dental visits regularly. However, our estimates of dental hygiene and gingival inflammation in this population reflect average periodontal condition (Table 4). It appears that in the context of this study, the use of a common oral hygiene regimen is not synonymous with a high standard of periodontal condition. There was no difference in this study between males and females regarding periodontal condition except for the RI, which was significantly more important in males.

### Intraarch relationship and periodontal condition

Varying degrees of correlation have been found between intraarch relationship and periodontal condition depending on the arch and the indices taken into account. Overall, it appears that, despite a normal hy-

**TABLE 7.** Spearman Rank Order Correlations Between Periodontal Condition and Intraarch Relationship in the Upper and the Lower Dental Arch[a]

| | | Periodontal Condition | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Hygiene | | Gingival Inflammation | | Periodontal Disease Severity | | |
| Intraarch relationship | | PII | RI | GI | GBI | CAL | PD | GR |
| Upper arch | CPD (IOTN) | 0.225* | 0.105 | 0.212* | 0.134 | 0.115 | 0.111 | 0.042 |
| | Crowding (ICON) | 0.101 | 0.177 | 0.111 | 0.076 | 0.087 | 0.055 | 0.017 |
| | Spacing (ICON) | 0.014 | −0.162 | −0.171 | −0.056 | −0.100 | −0.082 | −0.011 |
| Lower arch | CPD (IOTN) | 0.338** | 0.068 | 0.263** | 0.160 | 0.097 | 0.192 | −0.026 |
| | Crowding (ICON) | 0.297** | 0.192 | 0.377*** | 0.310** | 0.224* | 0.240* | 0.045 |
| | Spacing (ICON) | 0.047 | 0.028 | −0.131 | −0.147 | −0.054 | −0.087 | 0.014 |

[a] PII indicates Plaque Index; RI, Retention Index; GI, Gingival Index; GBI, Gingival Bleeding Index; CAL = clinical attachment loss; PD, pocket depth; GR, gingival recession.

* Correlation is significant at .05 level (two-tailed); ** Correlation is significant at .01 level (two-tailed); *** Correlation is significant at .001 (two-tailed).

**TABLE 8.** Spearman Rank Order Correlations Between Periodontal Condition and Interarch Relationship as Assessed by IOTN and ICON[a]

| | | Periodontal Condition | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Hygiene | | Gingival Inflammation | | Periodontal Disease Severity | | |
| Intraarch relationship | | PII | RI | GI | GBI | CAL | PD | GR |
| IOTN | Overjet | 0.216* | 0.153 | 0.139 | 0.157 | 0.095 | 0.115 | 0.001 |
| | Crossbite | −0.051 | −0.097 | 0.017 | −0.094 | −0.081 | −0.037 | 0.223* |
| | Overbite | 0.223* | 0.164 | 0.169 | 0.198* | 0.290** | 0.233* | 0.166 |
| | Open bite | 0.154 | 0.188 | 0.236* | 0.332** | 0.197* | 0.232* | −0.131 |
| ICON | Crossbite | −0.039 | −0.084 | 0.029 | −0.063 | −0.073 | −0.024 | 0.198* |
| | Overbite | 0.164 | 0.079 | 0.126 | 0.135 | 0.259** | 0.210* | 0.161 |
| | Open bite | 0.221* | 0.236* | 0.299** | 0.393*** | 0.249* | 0.273** | −0.112 |

[a] PII indicates Plaque Index; RI, Retention Index; GI, Gingival Index; GBI, Gingival Bleeding Index; CAL = clinical attachment loss; PD, pocket depth; GR, gingival recession.

* Correlation is significant at .05 level (two-tailed); ** Correlation is significant at .01 level (two-tailed); *** Correlation is significant at .001 (two-tailed).

giene regimen, the presence of malpositioned and crowded teeth in the mandibular arch is associated with difficulties in plaque removal and gingival inflammation. On the other hand, these parameters ranked lower in the maxillary teeth.

Comparisons with previous studies are complicated by virtue of the differences in methodological approaches and the indices used to assess both the periodontal and the occlusal conditions. Ingervall et al[11] also studied the relationship between crowding of teeth and gingival condition in a smaller sample of dental students of almost the same age bracket, as in subjects of this study. They found that crowding of teeth (tooth displaced by two mm or rotated for at least 15°) did not favor plaque accumulation on proximal tooth surfaces and influenced gingival inflammation only slightly.[11] Geiger et al[18] also found no significant correlation between crowding and periodontal condition. On the other hand, Buckley[8] in a study of 300 teenagers reported a low but significant correlation in the range of that found in this study between lower incisor crowding as assessed by the Occlusal Feature Index, the PII and the GI.

Although they did not rise to levels high enough to attain significance, the negative correlations between spacing and periodontal parameters indicate a trend toward more favorable periodontal condition in subjects with spaced dentition. Previous studies[19,20] reported the same trend. These findings question the indication for space closure specifically for esthetic reasons, although it might contribute to maintaining dental health.

The reason why crowding, although significantly correlated with hygiene and inflammation, is not correlated to disease severity is elusive. However, it is noteworthy that although gingivitis must precede periodontitis, not all gingivitis progresses to periodontitis.[21]

### Interarch relationship and periodontal condition

Concerning the interarch relationship, the results of this study indicate that open bite is more liable to induce morbidity with regard to the periodontium. This issue has not been investigated before because we found no study in the literature dealing with the influence of open bite on periodontal condition.

Crossbite, in this study correlates significantly with

GR but not with the other periodontal parameters studied. These results did not support the findings of al-Jasser and Hashim[9] and Hashim and al-Jasser,[10] who reported a significant relationship between crossbite and PII, GI, and PD in a smaller and younger sample. However, their study population may have differed with that of this study in terms of age and oral hygiene awareness. Silness and Roynstrand[22] also found that subjects with crossbite teeth had higher periodontal scores than those without. At last, in an extensive study involving 516 subjects, Geiger and Wasserman[23] reported no consistent association between this type of malocclusion and periodontal disease.

The correlation found in this study between crossbite and GR could be explained by primary occlusal trauma. In fact, the teeth in crossbite may be often in premature contact in centric relation and at the end of closing phase during mastication. The occlusal loads in such case are not properly distributed. Subsequently, the resistance of the periodontal tissues is overwhelmed which may lead to occlusal trauma and GR.

Overbite assessed with either IOTN or ICON was significantly correlated with clinical attachment loss and PD in this study but not with the parameters of hygiene and inflammation. These findings contrast with the report of Buckley[8] who used PII and GI as periodontal condition index and an assessment of overbite similar to that of ICON.

Overjet was weakly but significantly correlated with PII but not with the other indices of periodontal condition. Davies,[24] in a report of the preliminary results of an extensive longitudinal study involving nine hundred and fourteen 12-year-old children also reported a significant association between mean plaque score and anterior overjet. Geiger et al[25] found a slight association between severe anterior overjet and periodontal disease. In contrast, the results of Buckley's[8] investigation demonstrate an absence of correlation between incisal overjet and plaque and gingival index.

## CONCLUSIONS

- A weak but significant correlation was found between certain parameters of intraarch and interarch relationship and some indices of periodontal conditions.
- This study provides valuable indication on the usefulness of making orthodontic treatment on the ground of preservation of periodontal condition.

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