The Relationship of Malocclusion with Periodontal Status, Dental Caries, and Sociodemographic Factors in School Children of Ludhiana

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Aim: The aim of this study was to find the relationship of orthodontic malocclusion with periodontal status, dental caries, and sociodemographic factors. Materials and Methods: The study population comprised 400 school-going children of age 11–14 years. The severity of malocclusion was determined by Treatment Priority Index. The sociodemographic factors were evaluated using a questionnaire that enquired about age, gender, parents’ monthly income, and their educational status. Periodontal status was assessed using Community Periodontal Index of Treatment Need (CPITN) index. To know about dental caries, decayed, missing, filled teeth (DMFT) index was used in this study. Statistical Analysis Used: Spearman’s rank correlation coefficients were used to find an association between variables. The effect of sociodemographic factors on treatment priority index (TPI) scores was examined using Chi-square test. Student’s t-test (to compare TPI scores of different genders) and analysis of variance (to compare TPI scores among different age groups) were used in this study. Results: Out of a total of 400 children included in the study, 19.5% students had normal occlusion whereas a majority of them (80.5%) showed some sort of malocclusion. CPITN scores revealed that 3.1% pupils had no sign of the disease, 57.5% showed gingival bleeding after gentle probing, and 39.4% had supra or subgingival calculus. Conclusions: No statistically significant correlation was found between the orthodontic treatment need, periodontal status, and sociodemographic factors while a significant relation is observed of TPI with DMFT.

Keywords: Dental caries and sociodemographic factors, orthodontic treatment need, periodontal status

Introduction

Gardiner defines malocclusion as a condition in which there is a departure from the normal relation of the teeth to other teeth in the same arch or/and to teeth in the opposing arch. While malocclusion has been identified as a definite health problem by some,[1,2] others have referred to it not as a disease but morphological variation.[3,4] While dental caries has been regarded as the major dental disease throughout the world, malocclusion is a close runner-up. With fluoridation, there is a good chance for significant reduction of caries as a problem. The morphogenetic nature of most malocclusions assures us that this dentofacial problem will continue to demand the best that dentistry can offer for a long time.

Orthodontics today is not considered in the creation of esthetics alone, but as part of the health profession concerned with creation of physical and emotional well-being of an individual.

Malocclusion not only affects the appearance of an individual but it also has influence in many other ways such as interference with normal growth and development, improper or abnormal muscle function, speech defects, increased caries incidence, predilection to periodontal disease, and temporomandibular joint disorder.[5]

Measuring and recording the severity and prevalence of malocclusion is not only important for evaluating the occlusal status of participants in a community and establishing the treatment priority but also can be used as an epidemiological tool for preventive procedures or for training orthodontic specialists.

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Assessment of occlusal status for orthodontic purposes may be undertaken by subjective assessment or by means of an index of occlusion. In the orthodontic context, the index is used to describe a rating or categorizing system that assigns a numeric score or alphanumeric label to a person’s occlusion. Several indices have been developed to allow the categorization of malocclusion according to the level of treatment need. Examples are:

- Grainger’s treatment priority index
- Salzmann’s handicapping malocclusion assessment
- Summers’ occlusal index, primarily designed for epidemiological purposes, has also been used to determine treatment priority.

These indices yield a score for each trait or component that is then weighed to calculate an overall score. Index of orthodontic treatment need is a modification of this type.

Using these indices, several studies have presented epidemiological reports of the prevalence of malocclusion in different ethnic groups worldwide. However, in the literature, there are limited studies that analyze the relationship between malocclusion and dental problems such as caries and periodontal diseases. Moreover, not much data is available on the prevalence of dental diseases in children in North India, especially Punjab. Previous attempts to investigate a possible association of malocclusion and dental caries have shown fluctuating results. While some authors reported a positive association between malocclusion and dental caries, others could not establish any significant relationship. Moreover, conflicting results have been obtained in studies considering a possible relationship between malocclusion and periodontal status. The presence of a positive association between malocclusion and periodontal treatment need has been described by Helm and Petersen and Gábris et al., yet, other studies found no association between the two.

This study aims to determine the relationship of orthodontic malocclusion with factors such as periodontal status, dental caries, and sociodemographic status.

**Materials and Methods**

The study target population consisted of 400 children (230 males and 170 females) who were selected by cluster sampling. The selected children fulfilled the inclusion criteria of being in the defined age range of 11–14 years. Only consenting participants were included in the study, and none of the pupils invited for participation had a history of orthodontic treatment (either interceptive or elective). Ethical approval was obtained from the Research Committee of our institution.

Before commencing the present investigation, a pilot study on 20 children was performed. One trained examiner conducted all the clinical examinations under the supervision of two experienced orthodontists, one experienced pedodontist and two experienced periodontists with an assistant recording the observations to avoid interexaminer variations. The students were examined in the outpatient department of our dental hospital and also at the dental camps in various schools, in a quiet classroom without external interference, under natural or artificial illumination. The examination lasted approximately 15 min per child, following the World Health Organization (1985) guidelines. No radiographs, study casts, or previous written records were used in the study.

Before being clinically examined, the participants completed a questionnaire in a face-to-face interview. The contents of the interview included name, age, gender, father’s name, address, telephone number, parents’ monthly income, and parents’ educational status. These data were later compiled to determine the socioeconomic status of the study subject.

The caries experience was assessed using the decayed, missing, filled teeth (DMFT) score in accordance with the criteria by the World Health Organization (WHO) (1997). The teeth with caries or filled teeth with recurrent signs of caries were counted as decayed. Only the teeth lost due to caries were counted as missing while restored teeth with no caries were included as filled teeth. Only the permanent teeth were included. The fissure sealant, fixed dental prosthesis/bridge abutment, special crown, and veneer/implant were not included in the calculation of DMFT index.

The periodontal status was recorded using the Community Periodontal Index of Treatment Need (CPITN) scores as described by the WHO. A dental mirror, an explorer, and a periodontal probe were all that was needed to perform the index. The periodontal probe used was a specially designed lightweight CPI metallic probe with a 0.5 mm ball tip, black band between 3.5 and 5.5 mm, and rings at 8.5 and 11.5 mm from the ball tip. Usually, two indicators, that is, gingival bleeding and periodontal pockets are used for the assessment of periodontal status. The periodontal pockets are not recorded in individuals below 15 years of age. Since the study population comprised only of children up to 14 years, the CPITN scores were set so that 0 = no sign of disease, 1 = gingival bleeding after gentle probing, 2 = presence of supra or subgingival calculus, and X = tooth not present. Only six-index teeth were examined.

Treatment priority index (TPI) scores were used to assess the severity of malocclusion and determine orthodontic treatment need. It was so because it had the advantage of being simple and efficient to enable epidemiological surveys of malocclusion possible without undue cost and energy. Clinical examination was performed by one trained examiner. The items measured described the occlusal anomaly such as incisor relationship horizontally and vertically, occlusion of buccal segments, and tooth displacement. These syndromes were weighted according to the first molar relationship as mesiocclusion, neutroclusion, and distocclusion. The weights that corresponded to the recorded syndromes were summed and a total TPI score was calculated for each participant. The level of severity of a malocclusion was assessed according to the Malocclusion Severity Estimate. A modification of
this scale was used in the present study\textsuperscript{[22]} with the exception that the constant value for neutrality on the TPI form was scored for normal occlusion. In this regard, the severity level for normal occlusion was assessed as 0.27 and for minor manifestations of malocclusion as 0.27–\leq 3.99.

The data were compiled, tabulated, and statistically analyzed using (SPSS Inc., Chicago, IL, USA) software for Windows, version 13.0. The effect of age, gender, parents’ education levels, and parents’ monthly income and CPITN scores on TPI scores was studied using Chi-square test. The association between TPI, CPITN, and DMFT was provided by Spearman’s rank correlation coefficients. Furthermore, Student’s \( t \)-test was used to compare TPI scores for different genders while TPI scores for different age groups were compared using analysis of variance. A critical \( P = 0.05 \) was considered statistically significant.

**RESULTS**

We conducted this study on a total of 400 children that included 230 males and 170 females. The data listed in Table 1 show the monthly income of the parents while Table 2 shows the educational status of the parents. The combined data of Tables 1 and 2 depict the socioeconomic status of the study population. Table 3 delineates the orthodontic treatment need on the basis of the TPI scores. While 19.5% students had normal occlusion, 6.8% suffered from a very severe handicap. However, 39.4% had minor manifestations, 21.8% had definite malocclusion, and 12.5% showed severe handicap.

The relationship of various attributes such as age, gender, and socioeconomic status with the TPI score is shown in Table 4. The data clearly show that no statistically significant correlation is present between age, gender, socioeconomic status, and TPI scores \( (P > 0.05) \).

As shown in the pie chart in Figure 1 (CPITN scores), 3.1% pupils had no sign of the disease (Score 0), 57.5% showed gingival bleeding after gentle probing (Score 1), and 39.4% had supra or subgingival calculus (Score 2). These children were then segregated on the basis of the periodontal treatment need as described by the WHO. As such, 3.1% students required no periodontal treatment (TN 0), 57.5% needed an improvement in personal oral hygiene (TN 1), and 39.4% were in need of scaling along with improvement in personal oral hygiene (TN 2a). On further studying the interrelationship between TPI scores and CPITN scores [Table 5], we observed a statistically nonsignificant relation between the two \( (P = 0.09) \).

The correlation coefficients between TPI, CPITN, and DMFT scores are shown in Table 6. A significant relationship was found between TPI-DMFT scores \( (P = 0.04) \). On the other hand, no significant association between the TPI and CPITN scores was seen \( (P = 0.091) \). The correlation coefficients for the relationship between CPITN-DMFT scores were also not statistically significant \( (P = 0.24) \).

**Table 1: Monthly income of parents**

| Income (INR) | \( n \) (%) |
|-------------|--------------|
| \( \leq 10,000 \) | 57 (14.3) |
| 10,001-20,000 | 155 (38.8) |
| 20,001-30,000 | 93 (23.1) |
| 30,001-40,000 | 50 (12.5) |
| 40,001-50,000 | 25 (6.3) |
| >10,000 | 20 (5.0) |
| Total | 400 (100.0) |

INR: Indian rupee

**Table 2: Educational status of parents**

| Qualification        | Father, \( n \) (%) | Mother, \( n \) (%) |
|----------------------|----------------------|---------------------|
| Below secondary      | 10 (2.5)             | 12 (3.1)            |
| Secondary            | 53 (13.2)            | 93 (23.1)           |
| Higher secondary     | 152 (38.1)           | 120 (30.0)          |
| Graduation           | 158 (39.4)           | 150 (37.5)          |
| Postgraduation       | 27 (6.8)             | 25 (6.3)            |
| Total                | 400 (100)            | 400 (100)           |

**Table 3: Orthodontic treatment need on the basis of Treatment Priority Index score**

| TN                       | \( n \) (%) |
|--------------------------|-------------|
| Normal occlusion         | 78 (19.5)   |
| Minor manifestations     | 158 (39.4)  |
| Definite malocclusion    | 87 (21.8)   |
| Severe handicap          | 50 (12.5)   |
| Very severe handicap     | 27 (6.8)    |
| Total                    | 400 (100.0) |

TN: Treatment need

**Table 4: Association of variables with orthodontic treatment needs (Treatment Priority Index)**

| Variable                      | \( P \) |
|-------------------------------|--------|
| Age                           | 0.19   |
| Gender                        | 0.72   |
| Father’s education            | 0.4    |
| Mother’s education            | 0.3    |
| Monthly income of parents     | 0.2    |

**DISCUSSION**

Malocclusion and dentofacial deformity are conditions that constitute a hazard to the maintenance of oral health and interfere with the well-being of the person by adversely affecting dentofacial esthetics, mandibular function, or speech. The measurement of malocclusion as a public health problem is extremely difficult since most orthodontic treatment is undertaken for esthetic reasons and it is very difficult to estimate the degree to which the malaligned teeth or the dentofacial anomalies constitute a psychological hazard. Many organized
population surveys have been carried out in different parts of the world with the objective of estimating the prevalence of malocclusion and orthodontic treatment needs only. To the best of our knowledge, the present research is the first large population-based study considering the relationship between orthodontic treatment needs and dental caries, periodontal status, and sociodemographic factors among children in North India. The sample included kids of 11–14 years of age, who had not undergone orthodontic treatment of any kind. It has been noted that in studies concerning the malocclusion and orthodontic treatment needs, the material should be obtained from a well-defined population and be large enough and cover nonorthodontically treated children. The present sample seems to satisfy those requirements.

The purpose of this study was to know the relationship of orthodontic treatment need with other variables. The treatment priority index was selected for the evaluation of treatment needs as it has proven to be a useful epidemiological indicator of malocclusion. Although TPI might have some disadvantages, yet there is no universally accepted index that defines all characteristics of a malocclusion as this is a multifactorial problem. In addition, the advantages of this index are much more important. It has been found to be highly reproducible and valid. Application of the TPI is practicable and requires less clerical time when compared with the occlusal index. Thus, the TPI is a useful index for measuring the orthodontic treatment need.

The result of our study showed that 80.5% of the study population exhibited minor manifestations to very severe malocclusion. Our findings are in accordance with the previous study by Gábris et al., who found that 70.4% of 483 adolescents had orthodontic anomalies. This was also in concordance with the results of Nalcaci et al., where 63.6% of the study population showed some sort of malocclusion. Similarly, 63.8% of the children had slight to severe malocclusion in a study by Mlaya et al.

Our study concluded that no relationship existed among age, gender, socioeconomic status, and TPI scores. This result supports the findings of Nalcaci et al., who depicted a similar nonsignificant relation among the variables. Moreover, Guray et al. found no interdependence between age, gender, and TPI values. Not only this, but our result was similar to the findings by Dhar et al., Perillo et al., T. Uger et al., and Healey et al., who showed no significant difference in the TPI scores between genders. On the contrary, a positive association was depicted among prevalence of malocclusion and sociodemographic characteristics by Mlaya et al.

This study inferred that no statistical correlation prevailed between TPI scores and CPITN scores. This result was consistent with studies by Nalcaci et al., Katz, Buckley, and Arora and Bhateja. These authors found no association between bleeding on probing or calculus with the prevalence of malocclusion as seen in our result. In contrast, Mlaya et al., Gábris et al., Alexander et al., and Helm and Petersen showed a correlation between malocclusion and periodontal health. Orthodontic malocclusion is considered as an important factor in the etiology of the periodontal disease because irregular teeth may increase the retention sites and lead to periodontal problems.

Our study established a positive link between TPI and DMFT illustrating that malocclusions were associated with decayed, missed or filled teeth, as expected. This result was alike other studies. Nalcaci et al. found a significant correlation between TPI and DMFT scores. Furthermore, Mlaya et al. showed that children with DMFT >0 were more likely to be diagnosed with a malocclusion than compared to their counterparts with DMFT = 0. Similar results were obtained by Gábris et al. among the Hungarian adolescents. Moreover, Stahl and Grabowski reported that dental caries and premature loss of primary teeth are predisposing factors for occlusal and space anomalies in the mixed and permanent dentition. In addition to this, our finding was consistent with that of Singh et al., Baskaradoss et al., and Gaikwad et al., who also deduced

**Table 5: Interrelationship between Treatment Priority Index and periodontal treatment needs**

| TPI classification | Periodontal TN |
|--------------------|---------------|
|                    | TN 0, n (%) | TN 1, n (%) | TN 2A, n (%) | Total |
| Normal occlusion   | 2 (2.6)   | 53 (67.9) | 23 (29.5) | 78 (100) |
| Minor manifestations| 8 (5.0)  | 93 (58.9) | 57 (36.1) | 158 (100) |
| Definite malocclusion| 0        | 47 (54.0) | 40 (46)  | 87 (100) |
| Severe handicap     | 2 (4.0)   | 30 (60)   | 18 (36)  | 50 (100) |
| Very severe handicap| 0        | 7 (25.9)  | 20 (74.1) | 27 (100) |
| Total               | 12 (3.1)  | 230 (57.5)| 158 (39.4)| 400 (100) |

TPI: Treatment Priority Index, TN: Treatment Need

**Table 6: Association between Community Periodontal Index of Treatment Need, Treatment Priority Index and decayed, missing, filled teeth**

| CPITN (P) | TPI (P) | DMFT (P) |
|-----------|---------|----------|
| -         | 0.091   | 0.24     |
| 0.091     | -       | 0.04*    |
| 0.24      | 0.04*   | -        |

*P<0.05. DMFT: Decayed, missing, filled teeth, CPITN: Community Periodontal Index of Treatment Need, TPI: Treatment Priority Index
a positive correlation between the severity of malocclusion and DMFT.

Every study has certain limitations, and our study is not an exception in this regard. No radiographs or study casts were used in the present investigation. The probability of having under or overestimated the deviations of tooth positions cannot be overlooked. Nevertheless, given the sample size and the selection criteria used in this study, the findings provide a reasonably accurate indication of the occurrence of malocclusion in children of our district.

**Conclusions**

No statistically significant correlation was found between the orthodontic treatment need, periodontal status, and sociodemographic factors while a significant relation is observed of TPI with DMFT. This clearly indicates that prevention of dental caries will save the children from future orthodontic treatment needs. Furthermore, more awareness regarding oral health must be spread among the masses to limit the dental problems.

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**Conflicts of interest**

There are no conflicts of interest.

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