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Malocclusion and dental caries experience among 8–9-year-old children in a city of South Indian region: A cross-sectional survey

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Abstract:

BACKGROUND: Although numerous studies have documented malocclusion in various age groups in India, the literature on the prevalence of malocclusion in mixed dentition is scanty. Dental caries is another most common condition affecting the general health. However, its association with malocclusion in mixed dentition is not well known.

AIM: The purpose of this study was to establish the prevalence of malocclusion and its association with caries experience in 8–9-year-old children of Davangere city, South Indian region.

SETTING AND DESIGN: The study design was a cross-sectional survey.

MATERIALS AND METHODS: A total of 800 children from 350 schools (both males and females) were randomly selected for the study. *t*-test and Chi-square test were used for statistical analysis.

RESULTS: The overall prevalence of malocclusion among 8–9-year-old children was 40.9%. The most prevalent malocclusion was crowding (11.5%), followed by excessive overjet (9.4%), deep bite (6.8%), spacing (6.5%), crossbite (4.5%), and open bite (3.2%). Class I molar relationship prevailed in 95.5% of children.

CONCLUSION: The prevalence of malocclusion in our study was in accordance with the other studies reported in India, which ranged from 19.6% to 90%. Furthermore, correlation of malocclusion and dental caries in the primary dentition, although nonsignificant, presented children with malocclusion to have a higher caries experience than children without malocclusion.

Keywords:

Association, dental caries, malocclusion, prevalence, schoolchildren

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Introduction

Malocclusion can be defined as an irregularity of the teeth or malrelationship of both the arches beyond the range of what is accepted as normal. Malocclusion is one of the most common oral problems, together with dental caries, gingival disease, and fluorosis.[1] According to the World Health Organization, the main dental problems should be subjected to periodic epidemiological surveys. Knowledge of a population's epidemiological situation is vital for planning and providing prevention and treatment services.[2]

The reasons to develop malocclusion could be genetic or environmental, and/or a combination of both the factors, along with various local factors such as adverse oral habits, tooth anomalies, and form and developmental position of teeth, can cause malocclusion. The prevalence of

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malocclusion varies from country to country and among different age and sex group.[3] Globally, epidemiological studies on malocclusion show the prevalence ranging between 39% and 93%.[4] The prevalence of malocclusion in India varies from 19.6% to 90%.[5] The high prevalence of malocclusion implies that public health efforts are required as such conditions affect negatively the individual's quality of life, particularly in case of children and adolescents, who are sensitive about their appearance.[6] Caries and premature loss of primary teeth are considered predisposing factors for occlusal and space discrepancies in the mixed and permanent dentitions.[7] Dental caries is the other most common oral disease regardless of the fact that it is preventable.[8] Since its etiology is complex and there are several unexplained interactions among unknown confounders and risk factors, it is the most prevalent oral health problem worldwide.[9]

Various studies[1,3,7,10-12] have proved that there is a positive association between the prevalence of dental caries and malocclusion. Malocclusion causes limited access for the toothbrush, and the natural cleansing effect of the teeth by the tongue and saliva is also limited. It provides additional retention areas for food and plaque-making oral hygiene more difficult and thereby predisposes the teeth to the development of caries.[10]

Several studies have been conducted on children in the mixed dentition, but few studies in the Indian population approach with any degree of clarity the changes occuring during this period. With regard to the considerable variation in the reported prevalence of malocclusions and the inconclusive results of its possible association with dental caries, and the minimal data available, particularly in the mixed dentition, the present study was conducted to establish the prevalence of malocclusion and caries in 8–9-year-old children and also to assess its association with caries experience.

Materials and Methods

A descriptive cross-sectional study was conducted among 8–9-year-old schoolchildren of Davangere city, South Indian region. From an earlier study in the Indian population, it was found that the approximate prevalence of malocclusion was about 70%. An error of 10% was factored in, and we assumed the prevalence of malocclusion as 60%. Using the sampling formula, a minimal sample size of 600 was chosen. An additional 200 children were added to further offset any losses. Thus, 800 children were randomly selected and stratified according to age and school. Before the start of the study, ethical clearance was obtained from the ethical clearance committee of our college, Davangere. An official permission was obtained from the Officer of the Deputy Director of Public Instructions Office, Davangere city. The study was conducted over a period of 4 months.

Test–retest reliability

Training in the epidemiologic/clinical methodology and calibration of the examiner before the study were performed, where the examiner and supervisor jointly examined subjects and discussed the findings, according to the diagnostic criteria. This process continued until reliability was achieved. The training ended with double examination of twenty children, yielding an intraexaminer kappa value of 0.8.

Examination

Oral examination was performed by a single trained and calibrated examiner. Two-stage sampling procedure was adopted to select the sample. Among 350 primary and higher primary schools in the north and south zones of Davanagere City, 10 schools (equal numbers of private and government schools) were selected by using simple random sampling procedures in the first stage. Among the ten schools, the study subjects were selected by using systematic random sampling procedures. Males and females were selected proportionately and 80 school children were examined in each selected school. Twenty subjects were being examined daily for a minimum of 10 days in a month, keeping in mind the holidays and test examinations of schoolchildren. The examination of a single study subject took 3–4 minutes. Those children who refused to participate were excluded. Furthermore, medically compromised children and the children who had or who were having orthodontic treatment, including those on interceptive orthodontics, were excluded from the study.

Before the clinical examination, parents and children were informed about the procedure and informed parental consents were obtained.

A survey proforma was created to gather data from the sample. The children were examined by a single examiner under natural light (Type III examination) as suggested by the American Dental Association, 1970.

Criteria for each assessment (Profitt 4th Edition, 2007) were defined as follows:

- Molar relationship as described by Angle; three classes of malocclusion, based on occlusal relationships of the first molars
- Overbite was positive if incisors overlapped vertically. Negative overbite was equivalent to open bite. Excessive overbite or deep bite was considered >3.5 mm
- Overjet was positive if upper incisor was ahead of lower incisor and negative if the lower incisor was in front of the upper incisor. Excessive overjet was considered >3.5 mm

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- Anterior and posterior crossbite was considered if teeth displaced facially or lingually past cusp to cusp
- Crowding-drift >1 mm between the contact points of permanent teeth shifted away from arch line
- Spacing - >2 mm
- Teeth affected by dental caries and teeth restored/extracted as a sequelae of dental caries were recorded using decayed, missing, and filled teeth (DMFT) index (Henry Klein, Carrole E. Palmer, and Knutson J. W., 1938) for the permanent teeth and the "def" index by Gruebbel in 1944 as an equivalent index to DMF for measuring dental caries in the primary dentition.

No discrimination was made between unilateral and bilateral for any type of malocclusion. The children having Class I molar relation with minor deviations from the concept of ideal occlusion were classified as normal.[6] Plain mouth mirror and probe were used for examination. Sufficient number of autoclaved instruments were carried to the examination site to avoid the interruption during the study. After each day of examination, the entire instruments were autoclaved.

Statistical analysis

The data recorded were transferred from survey proforma to an MS-Excel Sheet in a computer.

The response obtained was tabulated and the results were expressed as frequency distributions and computed in percentage using SPSS software version 19 (Statistical Package for Social Sciences Statistics for Windows, Armonk, NY: IBM Corp). The observations were statistically analyzed using the Chi-square test for categorical data and Student's unpaired *t*-test for quantitative mean difference. $P < 0.05$ was considered for statistical significance.

Results

Class I malocclusion was represented by 36.4% of the 800 children examined. While Class I normal occlusion was found in 59.1%, Class II malocclusion in 3.9%, and Class III malocclusion in 0.6% of children [Table 1]. Table 2 depicts the prevalence of orthodontic anomalies in the study group. Table 3 describes an association between dental caries and malocclusion.

Discussion

A cross-sectional study was carried out to assess the prevalence of malocclusion and dental caries among 8–9-year-old children in Davangere city, South India. Most studies[4,13,14] that evaluate the prevalence of malocclusions use samples that include various age groups. The present study covered an age group which orthodontic clinics are the most sought after due to the emergence of clinical situations that involve alterations in the arches and faces. This could be attributed to the normal sequence of eruption in 9-year olds as many deciduous teeth exfoliate at this age. Moreover, this is a period of growth and development during which many professional interventions can be made, leading to numerous benefits for these individuals. However, very few studies have been conducted with regard to prevalence of malocclusion in mixed dentition and their correlation with dental caries in India. However, in the South Indian region, none of the studies have been conducted regarding the association between malocclusion and dental caries in mixed dentition. Therefore, the present research sample consisted of schoolchildren of 8–9 years age group.

Table 1: Molar relation

Molar relation	*n* (%)	Females, *n* (%)	Males, *n* (%)
Normal occlusion	473 (59.1)	241 (30.1)	232 (29.0)
Class I	291 (36.4)	140 (17.5)	151 (18.8)
Class II	31 (3.9)	16 (4.0)	15 (3.8)
Class III	5 (0.6)	3 (0.8)	2 (0.5)

Table 2: Prevalence of malocclusion

Orthodontic anomalies	*n* (%)	Females, *n* (%)	Males, *n* (%)
Open bite	26 (3.2)	10 (2.5)	16 (4.0)
Deep bite	52 (6.5)	31 (7.8)	21 (5.2)
Anterior crossbite	35 (4.4)	18 (4.5)	17 (4.2)
Increased overjet	75 (9.4)	33 (8.2)	42 (10.5)
Crowding	177 (22.1)	87 (22.7)	90 (22.5)
Spacing	52 (6.5)	25 (3.2)	27 (3.3)

Table 3: Association between caries and malocclusion

Malocclusion	Mean DMFT	SD	*P*	Mean dmft	SD	*P*
Yes	0.27	0.76	0.63	2.01	2.13	0.88
No	0.24	0.68		2.03	2.29	

DMFT=Decayed, missing, and filled teeth, SD=Standard deviation

Molar relation

The qualitative angle method was chosen for this study due to worldwide acceptance of its reliability, universal nature, and its ease of reproduction and also due to the fact that it minimizes the observer's subjectivity, bringing information to a larger number of dental professionals, including general practitioners, specialists, and public health workers.[15]

In accordance with the findings of previous studies,[1,4,15] the predominant molar relationship was angle Class I (95.5%) in the present study. Overall, 59.1% had Class I normal occlusion and prevalence of Class I malocclusion was found to be 36.4%. The prevalence of Class I malocclusion was lower when compared to Nigerian children (50.0%)[16] and

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Brazilian children (47.6%).[6] However, a study done by Das *et al*.[17] in Bangalore city among the age group of 8–12 years showed higher prevalence of Class I malocclusion 61.6%, with crowded incisors being most common finding. Furthermore, they concluded that there is no significant difference between boys and girls neither in the overall prevalence of malocclusion nor in various forms of malocclusion, which was a consistent finding in the present study as well [Table 1]. However, much lower prevalence of Class I malocclusion was also cited in literature (14%) by Gauba among North Indian children where 70.8% had normal occlusion.[18]

Further, in the present study, lower prevalence of 3.9% for Class II malocclusion was found. Other studies which presented related data of lower prevalence were in South Indian children (8.4%) by Das *et al*.,[17] North Indian children (13.5%) by Guaba *et al*.,[18] and African children (13.7%) by Onyeaso 2004.[16] The lower prevalence of Class III malocclusion is confirmed by various studies.[6,15,16,18] The figure of 0.6% for Class III malocclusion in the present study agrees with 0.6% reported by Das *et al*.[17] The values found in our children are closer to that found in North Indian children (1.3%) by Guaba.[18]

A study done on Bogotian 5–17-year-old children showed that the prevalence of Class II and Class III malocclusion is 20.8% and 3.7%, respectively, with no gender difference. However, differences between the developmental periods were observed, for example, decreasing prevalence of Class II but increasing prevalence of Class III, especially from the late mixed to permanent dentition.[4]

Overbite

In the present study, 6.8% children had increased overbite. However, it was not as prevalent as among Brazilian children (36.7%),[19] but is comparable to that presented by Nigerian children (14.1%) .[16] Among the children in Bogota, the prevalence of increased overbite (>4 mm) was 21.6%.[4]

The prevalence of open bite was 3.2% in this study. Shivakumar *et al*. in 2009 presented 2.1% of study subjects with ≥1 mm vertical anterior open bite which was comparable to our study.[3] In contrary, the prevalence of open bite in Bogotian children was reported as high as 9% where it was found most frequently in deciduous and early mixed dentition, decreased in the late mixed dentition, and increased again in the permanent dentition.[4] This difference could be due to variation in the development and maturation of the arches, and the children may have had different deleterious oral habits, mouth breathing, tongue thrusting, and dentoalveolar discrepancies of the jaws.[3]

Overjet

It was found that 90.6% had normal overjet in our study. With respect to overjet, Lux *et al*. in 2009 reported that between 8 and 11 years, majority of children either exhibited an ideal overjet or a moderately increased overjet.[20] This is similar to the findings in the present study: prevalence of increased overjet was higher than decreased or reverse overjet.

Crowding and spacing

Anterior irregularity may be either rotations or displacement of contact points from normal alignment.[3] This irregularity may affect many children in the mixed dentition, and it worsens in adolescent years as the permanent teeth erupt and continues to increase as the age progresses.[21] In our study, we found that 22.1% had anterior dental crowding. There are varied prevalence data found in different regions. In a study by Gábris *et al*. among Hungarian adolescents, the reported prevalence was 14.6%.[11] In the study by Shivakumar *et al*. among schoolchildren in Davangere city, 38.2% of the study population had incisal crowding.[3] Among the children in Ceara[19] and Bogotian children,[13] the reported prevalence of overall crowding was 62% and 52.1%, respectively, which is much higher than our study. Generally, in most of the malocclusion cases, crowding may be due to the abnormal tooth positions, racial, and genetic variations of the study group.[3] Baskaradoss *et al*. found a significant relationship between anterior crowding and the habitual open mouth posture in the early mixed dentition. In the mixed dentition, premature loss of primary teeth and proximal caries supporting tooth loss could also cause crowding.[7]

Furthermore, the prevalence of spacing was 6.5% in the present study including midline diastema, which is much less compared to the study by Thilander *et al*.[4] among Bogotian children who found spacing 15.1% and only median diastema prevalence to be 13.5% in early mixed dentition.

Crossbite

The prevalence of crossbite was found to be 4.4% which was in agreement (5.7%) with Brazilian schoolchildren.[6] In females, we found that 4.5% had crossbite and in males 4.2%, which was statistically nonsignificant (P = 0. 80). Similar results of anterior crossbite were reported by Luzzi *et al*. in 2011 among German children, 5.1% in females and 3.4% in males.[22]

Orthodontic anomalies were found in 40.9% of the individuals in our study. Generally, the present study showed a lower prevalence of anterior open bite and crossbite, but a higher prevalence of crowding. These findings were comparable to Bogotian schoolchildren

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Black Americans but reported a higher prevalence of crowding than in Europeans and White Americans.[4]

Malocclusion versus dental caries

In our study, when the correlation of dental caries and malocclusion among the study subjects was studied, in the permanent dentition, 13.5% of the subjects who had malocclusion experienced dental caries, and in the primary dentition, score was 60.9%, which was statistically insignificant [Table 3]. In addition, a study conducted by Luzzi *et al*. in 2011 did not show a statistically significant association between caries and clinical orthodontic abnormalities, except for the association between the midline deviation and the extraction of a deciduous element ($P = 0.07$).[22] Similarly, a South Indian study by Baskaradoss *et al*., 2013 showed that children with Dental Aesthetic Index scores of >35 were found to have a significantly higher caries experience although it was nonsignificant.[7] In a study by Buczkowska-Radlinska *et al*. in 2012 among Polish children with crowded teeth in the primary and mixed dentition did not have more caries than children without crowding. The lack of relationship between crowding and dental caries in the anterior teeth in primary and mixed dentition may be related to the shorter period of exposure to caries promoting conditions. However, they concluded that in adolescents, anterior crowding, and tooth brushing twice a day or less without the use of interdental cleaning aid can be considered risk factors for dental caries.[10]

Although Mtaya *et al*.[1] and Gábris *et al*.[11] found children with caries experience (DMFT >0) two times more likely to have any type of malocclusion, compared with their counterparts without caries experience (DMFT = 0). Data reveal that orthodontic anomalies, principally crowding, may be associated with susceptibility to plaque retention and caries.[11] Dental caries was further associated with an Angle Class II/III molar relationship, where children with DMFT >0 were two times more likely to be diagnosed with an Angle Class II/III than children with no caries. Untreated proximal caries in primary molars or early loss of a second primary molar may lead to forward drift of the first permanent molar, promoting a change in the molar relationship.[23]

Conclusion

The primary aim of this study was to explore the prevalence of malocclusion and its association with dental caries in mixed dentition. Malocclusion still remains a serious problem in India because of its high prevalence and incidence. There are limitations to generalizing the findings and the data collected from examination should be interpreted with caution. The children could not be relied upon for the information and the collection of information from the school was not feasible; hence, the study has not identified socioeconomic and behavioral determinants in both dentitions. With the results of the present study, emphasis should be on planning for oral health promotion in schools, as early as a mixed dentition stage. Furthermore, teachers and parents should be made aware of malocclusion and dental caries, and encourage healthy lifestyles. In a country like India, which lacks public resources for oral health care, a national oral health policy that emphasizes on prevention would be beneficial.

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Conflicts of interest

There are no conflicts of interest.

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