Assessment of Malocclusion Status, Dentition Status, and Treatment Needs among 15-year-old School Children of Mangalore

Abstract

Background and Objectives: Dental caries and malocclusion are common dental public health problems. Surveys provide us with an insight into the oral health status and treatment needs and also help in proper treatment planning. Hence, the objective of this study was to assess the malocclusion status, dentition status, and treatment needs of 15-year-old school children of Mangalore.

Methodology: A cross-sectional study of 1001 school children aged 15-year-old was conducted in Mangalore. Their malocclusion status, dentition status, and treatment needs were recorded using the WHO oral health assessment pro forma. Statistical analysis was done using Statistical Package for Social Sciences version 17. Descriptive statistics was obtained and Chi-square test was used. The level of significance was set at 0.05. Results: Decayed teeth were prevalent in 45.5% of the study subjects. Malocclusion was present in 30% of the study subjects. Teeth missing due to caries and those requiring extraction and prosthetic rehabilitation were significantly higher in government schools (P < 0.05). Malocclusion and treatment need was significantly higher in government schools (P < 0.05). Conclusion: From the present study, we can conclude that the school children aged 15 years of Mangalore had varied malocclusion status, dentition status, and treatment needs with significantly higher treatment needs and malocclusion among children of government school.

Keywords: Dental caries, dentition, malocclusion, oral health

Introduction

Oral and dental health cannot be disassociated from the broader context of general health; oral diseases qualify as major public health problem due to their high prevalence and incidence in all regions of the world.[1]

Dental caries is an important dental public health problem, and it is the most prevalent oral disease among children in the world. The prevalence pattern of dental caries not only varies with age, sex, socioeconomic status, race, geographical location, food habits, and oral hygiene practices but also within the oral cavity.[2]

Dental caries is the most prevalent dental affliction of childhood. Despite credible scientific advances and the fact that caries is preventable, the disease continues to be a major public health problem. In developing countries, changing lifestyles and dietary patterns are markedly increasing the caries incidence.[3] Its very high morbidity potential has brought this disease into the main focus of the dental health profession. There is practically no geographic area in the world where inhabitants don't exhibit some evidence of dental caries. It not only causes pain and discomfort but also, in addition, places a financial burden on the parent. The prevention of dental caries has long been considered as an important task for the health profession.[4]

Although the gradual reduction of caries rates has led to new expectations concerning the public health strategies targeting malocclusion, the high demand for orthodontic treatment remains a challenge, mainly due to the scarcity of financial resources, affecting developing countries. Rational planning of health actions aiming orthodontic care demands epidemiologic data, and priority should be given to those with greater severity.[5]

Malocclusion is defined as an irregularity of the teeth; oral mal-relationship of the dental arches beyond the range of what is accepted as normal. Maloccluded teeth can cause psychosocial problems related to impaired dentofacial esthetics, disturbances of oral function, such as mastication, swallowing, and speech, and greater susceptibility to trauma and periodontal disease.[6]

For reprints contact: reprints@medknow.com

Address for correspondence:
Dr. Roshan Shetty,
Department of Public Health Dentistry, A. J. Institute of Dental Sciences, Kuntikhana,
Mangalore, Karnataka, India.
E-mail: drroshanshetty@gmail.com

How to cite this article: Shetty R, Hegde V, Shetty P.J. Assessment of malocclusion status, dentition status, and treatment needs among 15-year-old school children of Mangalore. Indian J Dent Res 2018;29:109-16.
Most malocclusion can be corrected if detected early by correctional methods. Growth and maturation of the jaws almost get completed by 16 and 17 years. Hence, correcting the malocclusion at this age will reduce the chances of the relapse which otherwise might take place during the active growth period of the local skeletal tissue.\(^7\)

Proper treatment planning can reduce the incidence of dental caries or malocclusion. Surveys provide us with an insight into the oral health status and treatment needs and also help in proper treatment planning. Hence, this study was conducted to assess the malocclusion status, dentition status and treatment needs among 15-year-old school children of Mangalore.

**Methodology**

**Study design**

A cross-sectional study was conducted to assess the malocclusion status, dentition status, and treatment needs among 15-year-old school children of Mangalore.

**Study population and selection**

The study population comprised of 15-year-old school children from 61 schools of Mangalore which were government, aided, and private. There were 61 schools in Mangalore of which 10 were government schools, 32 were aided schools, and 19 were private schools the list of which was obtained from the block education officer of Mangalore.

The subjects were selected based on the following inclusion and exclusion criteria:

**Inclusion criteria**

- Children whose parents gave consent and children assenting to participate in the study
- Subjects present on the day of examination.

**Exclusion criteria**

- Any physical limitations where children cannot open the mouth
- Intellectually disabled.

**Ethical clearance**

The study was reviewed and approved by the institutional ethical committee. Informed consent was obtained from parents before enrolment and assent were obtained from children.

**Calibration of the examiner**

The examination was done by a single examiner. The data were recorded by a trained post graduate student from the department who was the recorder. Intra-examiner calibration of the examiner was carried out by conducting an examination of 20 children at two different intervals, and the reliability of the examinations was assessed using Kappa statistics. The coefficient was found to be 0.76, reflecting a high degree of agreement in the observations.

**Sample size determination**

The sample size was determined based on National oral health survey and fluoride mapping, Karnataka 2002–2003 where the prevalence of decayed, missing, and filled teeth (DMFT) in the urban area was found to be 38%. The confidence interval was fixed at 95% and the power of the study as 90%.

Sample size was determined using the formula

\[
n = \frac{Z^2_{\alpha/2}pq}{E^2}
\]

where \(P = 38\%\) (prevalence of DMFT of urban area)

\(q = (1-p) = 62\%\)

\(E = 10\% \text{ of } P = 3.8\)

Substituting the values in the formula, \(n = 626.7\)

On the basis of the formula, the sample size was estimated to be 627. Schoolchildren who were selected from government, aided, and private schools based on 1:10:4 ratio. This ratio was based on a total number of 15-year-old school children from the government, aided, and private schools of Mangalore which were found to be 316, 3500, and 1045, respectively. The number of enrolment of children in schools was obtained from the block education officer, Mangalore.

**Examination procedure**

School children aged 15 years attending either private or government aided or unaided schools of Mangalore were included in the study. The study subjects were selected based on convenience sampling. After obtaining parental consent and children’s assent, they were examined. The study subjects were examined at the schools. Their malocclusion status, dentition status and treatment needs were recorded using the WHO oral health assessment pro forma (1997). Mouth mirror and CPI probe were used for examination. Subjects requiring treatment were referred to the dental college for further treatment.

**Data analysis**

The data obtained was coded and fed into the SPSS (Statistical Package for Social Sciences, Chicago, SPSS Inc.) version 17 for analysis. Descriptive statistics was obtained and Chi-square test was performed.

**Results**

The study population comprised of 1001 school children aged 15 years with 54.9% being males and 45.1% being females. Among them, 39.6% of the study subjects studied in aided schools, 31.4% studied in private schools, whereas 29% of them studied in government schools of Mangalore.
Table 1 shows the dentition status of the study subjects. Decayed teeth were prevalent in 45.5% of the study subjects.

Table 2 shows the distribution of treatment needs among study subjects. One surface filling was required in 37.5% of the study subjects, whereas 17.3%, 7.3%, and 1.8% of the study subjects required two or more than two surface fillings, pulp care and prosthetic rehabilitation, respectively.

Table 3 shows the distribution of study subjects based on the severity of malocclusion and treatment needs. Minor malocclusion with no or slight need for treatment was prevalent in 70% of the study subjects, definite malocclusion requiring selective treatment was present in 16.2% of participants.

Table 4 shows the comparison of dentition status among students studying in private, aided and government schools of Mangalore. Decayed teeth were prevalent in 45.1%, 46.7%, and 44.1% of students in private, aided and government schools. Filled teeth with decay were present in 8% of the students in aided schools. Filled teeth were prevalent in 5.7%, 9.8%, and 5.5% of private, aided, and government schools, respectively, and there was a statistically significant difference between the groups ($P < 0.05$). Teeth missing due to caries was prevalent in 1% and 4.8% of aided and government schools and there was a statistically significant difference between them ($P < 0.05$). Teeth affected due to trauma were present in 2.5% of aided schools and 0.7% of government schools and there was a statistically significant difference between the groups ($P < 0.05$).

Table 5 shows the comparison of treatment needs among students studying in private, aided and government schools of Mangalore. One surface filling treatment was required among 37.5%, 38.7%, and 35.5% of students in private, aided, and government schools. Extraction was required among 0.5% and 2.1% of students in aided and government schools, and there was a statistically significant difference between them ($<0.05$). Prosthetic rehabilitation was required among 1% and 4.8% of aided and government schools, and there was a statistically significant difference between them ($P < 0.05$).

Table 6 shows the comparison of dentition status among males and females. Decayed teeth were prevalent in 44.4% of males and 46.8% of females. Filled teeth with decay were present in 0.7% of females and it was statistically significant ($P < 0.05$). Filled teeth were prevalent in 9.3% of males and 4.9% of females and their difference was statistically significant ($P < 0.05$).

Table 7 shows the comparison of treatment needs among males and females. One surface filling treatment was required among 36.2% and 38.8% of males and females, respectively.
Table 5: Comparison of treatment needs among study subjects of private, aided and government schools

| Treatment needs                                 | Private (%) | Aided (%)  | Government (%) | χ²    | P    |
|-------------------------------------------------|-------------|------------|----------------|-------|------|
| Teeth requiring one surface filling             | 118 (37.5)  | 153 (38.7) | 103 (35.5)     | 0.740 | 0.691|
| Teeth requiring more than one surface filling   | 60 (19)     | 73 (18.4)  | 40 (13.8)      | 3.524 | 0.172|
| Teeth requiring crown                           | 0           | 2 (0.5)    | 4 (1.4)        | 4.919 | 0.085|
| Teeth requiring pulp care                       | 17 (5.4)    | 33 (8.3)   | 23 (7.9)       | 2.484 | 0.289|
| Teeth requiring extraction                      | 0           | 2 (0.5)    | 6 (2.1)        | 8.686 | 0.012|
| Teeth requiring Prosthetic rehabilitation       | 0           | 4 (1)      | 14 (4.8)       | 22.232| 0.000|

P<0.05 is significant

Table 6: Comparison of dentition status among study subjects according to gender

| Dentition status                  | Males (%) | Females (%) | χ²    | P    |
|-----------------------------------|-----------|-------------|-------|------|
| Decayed teeth                     | 244 (44.4)| 211 (46.8)  | 0.586 | 0.444|
| Filled with decay                 | 0         | 3 (0.7)     | 3.670 | 0.055|
| Filled                            | 51 (9.3)  | 22 (4.9)    | 7.079 | 0.008|
| Missing due to caries             | 11 (2)    | 7 (1.6)     | 0.282 | 0.596|
| Missing due to other reasons      | 8 (1.5)   | 2 (0.4)     | 2.561 | 0.110|
| Trauma                            | 4 (0.7)   | 8 (1.8)     | 2.292 | 0.130|

P<0.05 is significant

Table 7: Comparison of treatment needs among study subjects according to gender

| Treatment needs                                 | Males (%) | Females (%) | χ²    | P    |
|-------------------------------------------------|-----------|-------------|-------|------|
| Teeth requiring one surface filling             | 199 (36.2)| 175 (38.8)  | 0.690 | 0.406|
| Teeth requiring more than one surface filling   | 90 (16.4) | 83 (18.4)   | 0.721 | 0.396|
| Teeth requiring crown                           | 3 (0.5)   | 3 (0.7)     | 0.060 | 0.807|
| Teeth requiring pulp care                       | 49 (8.9)  | 24 (5.3)    | 4.717 | 0.030|
| Teeth requiring extraction                      | 1 (0.2)   | 7 (1.6)     | 5.869 | 0.015|
| Teeth requiring Prosthetic rehabilitation       | 11 (2)    | 7 (1.6)     | 0.282 | 0.596|

P<0.05 is significant

More than one surface filling treatment was required among 16.4% of males and 18.4% of females. Pulp care was required among 8.9% of males and 5.3% of females, and there was the statistically significant difference between the two (P < 0.05). Extraction was required among 0.2% and 0.16% of males and females, respectively, and there was a statistically significant difference between them (<0.05).

Table 8 shows the comparison of severity of malocclusion and treatment indications among students studying in private, aided, and government schools of Mangalore and there was a statistically significant difference between the groups (P<0.05).

Table 9 shows the comparison of severity of malocclusion and treatment indications among males and females and there was no statistically significant difference between the groups (P > 0.05).

Discussion

Good oral health is important due to the experience of pain, problems with eating, chewing, smiling, and communication due to missing, discolored, or damaged teeth having a major impact on people’s daily lives and well-being. Furthermore, oral diseases restrict activities at school, at work, and at home causing millions of school and work hours to be lost each year throughout the world. Children who suffer from poor oral health are 12 times more likely to have more restricted activity days including missing school than those who do not. As dental caries is the most common dental disease with high prevalence, it is crucial to control the disease process by assessing and rendering the treatment required along with spreading awareness regarding its prevention.[9]

However for developing appropriate preventive approaches, anticipating utilization patterns, and planning effectively for organization and financing of dental resources, the knowledge of oral health status and treatment needs of populations with different characteristics is important.

Data were obtained from children 15 years of age because at this age the permanent teeth have been exposed to the oral environment for 3–9 years. The assessment of caries prevalence is therefore often more meaningful than 12 years of age.[11] The school children were evaluated as the schools remain an important setting, offering an efficient and effective way to reach children worldwide and through them, their families can be reached. School age is an influential stage in people’s life when lifelong sustainable oral health-related behaviors, as well as beliefs and attitudes, are being developed. Children are particularly receptive during this period, and the earlier the habits are established, the impact is long lasting. Moreover, the messages can be reinforced regularly throughout the school years.[9]

In this study, there were 54.9% of males and 45.1% of females. This distribution is similar to the gender distribution observed in a study conducted by Hegde and Shenoy[9] among 15-year-old school children of Mangalore where 60.1% of the participants were males, and 39.9% were females.

This study sample comprised of school children from private, aided and government schools to have a representation of children from all the social, economic, and cultural communities. In the present study, there were 31.4% of students from private schools, 39.6% of students from aided schools and 29% of students from government
Table 8: Comparison of severity of malocclusion and treatment needs among study subjects of private, aided and government schools

| Severity of malocclusion                  | Treatment needs    | DAI score | Private (%) | Aided (%) | Government (%) | $\chi^2$ | P   |
|------------------------------------------|--------------------|-----------|-------------|-----------|----------------|---------|-----|
| No abnormality or minor malocclusion     | No or slight need  | $<$25     | 228 (72.4)  | 281 (71)  | 192 (66.2)     | 13.346  | 0.038 |
| Definite malocclusion                    | Elective           | 26-30     | 40 (12.7)   | 74 (18.7) | 48 (16.6)      |         |     |
| Severe malocclusion                      | Highly desirable   | $<$25     | 30 (9.5)    | 32 (8.1)  | 37 (12.8)      |         |     |
| Very severe or handicapping malocclusion | Mandatory          | $\geq$36  | 17 (5.4)    | 9 (2.3)   | 13 (4.5)       |         |     |

$P<0.05$ is significant. DAI=Disease Activity Index

Table 9: Comparison of malocclusion status and treatment needs among study subjects according to gender

| Malocclusion status                      | Treatment needs    | DAI score | Males (%) | Females (%) | $\chi^2$ | P   |
|------------------------------------------|--------------------|-----------|-----------|-------------|---------|-----|
| No abnormality or minor malocclusion     | No or slight need  | $<$25     | 389 (70.7) | 312 (69.2)  | 6.501   | 0.090|
| Definite malocclusion                    | Elective           | 26-30     | 94 (17.1) | 68 (15.1)   |         |     |
| Severe malocclusion                      | Highly desirable   | $<$25     | 53 (9.6)  | 46 (10.2)   |         |     |
| Very severe or handicapping malocclusion | Mandatory          | $\geq$36  | 14 (2.5)  | 25 (5.5)    |         |     |

$P<0.05$ is significant. DAI=Disease Activity Index

Schools of Mangalore. According to the data obtained from the block education officer at Mangalore, the maximum number of 15-year-old school children were from aided schools, followed by private schools and government schools similar to the distribution seen in the present study.

In the present study, 45.5% of the study subjects had decayed teeth, 0.3% had filled with decay, 7.3% had filled teeth, 1.8% had missing due to caries, whereas 1% had teeth missing due to other reasons. According to the National oral health survey 2002–2003,[8] in India, the prevalence of dental caries experience among 15-year-old subjects was 63.1% which is similar to the findings of the present study. The results of the present study are in accordance with the results of the study conducted by Shailee et al.[9] where the prevalence of dental caries was found to be 42.2% in 15-year-old school children of Shimla city. Dental caries forms to be a major risk among school children, which may be due to the cumulative effect. The missing component and the filled component contributed very little to the total DMFT scores. This indicates that there is a need for professional care. It was stated by Hegde and Shenoy[10] that the number of students with decayed component was more than the other components of DMFT.

In the present study, 37.5% of children required one surface filling, followed by 17.3% of the study subjects requiring more than one surface filling which was more as compared to other treatment needs. The findings of the present study are similar to the results of the National oral health survey 2002–2003,[8] in India where the prevalence of subjects requiring one or more than one surface fillings was 59.4%. Similar results were shown by Rodrigues and Damlo[11] and Kulkami and Deshpande.[12] The treatment need is very important as it gives an insight to the resources required. Measures like dental health education, fluoride application, and diet counseling play a vital role in reducing dental caries.

In this study, 70% of the school children aged 15 years required no orthodontic treatment. Definite malocclusion requiring elective treatment was present in 16.2% of the study subjects. Nearly 9.9% and 3.9% of them had severe and handicapping malocclusion, respectively, requiring mandatory treatment. According to the National oral health survey 2002–2003[8] in India among the 15-year-old children, 76.1% had no malocclusion, 14.6% had definite malocclusion, 4.8% had severe malocclusion, and 4.5% had very severe malocclusion similar to the findings of the present study. These results are in agreement with the findings of ShivKumar et al.[13] The results were also in accordance with the study carried out by Hegde and Shenoy[10] who carried out a study to investigate the treatment needs and malocclusion status among 15-year-old school children of Mangalore. The authors stated that 80.3% of the study population had no abnormality or little malocclusion, requiring no or slight orthodontic treatment. Nearly 9.6% had definite malocclusion requiring elective treatment and 6.9% had a severe type of malocclusion requiring highly desirable orthodontic treatment and only 3.2% of study population had severe or handicapping malocclusion requiring mandatory orthodontic treatment.

In the present study, decayed component of caries experience was present in 45.1%, 46.7%, and 44.1% of school children in private, aided, and government schools. Filled teeth were prevalent in 5.7%, 9.8%, and 5.5% of private, aided, and government schools. This high proportion of unrestored teeth is consistent with the findings from other developing and developed countries.[14,15] A low perception of the need for treatment and low priority placed on oral health care compared with other needs could be the reason for not restoring the teeth.[15,16] A child’s economic background has also been shown to influence the probability of seeking dental care. The study showed that the level of caries was 4.8% in children attending government schools which is in accordance with the findings of de Almeida et al.[16] but in contrast to results reported by Taani et al.[17] who showed that there was more caries experience in private school pupils than among the public school as measured by
DMFT (4.95:4.47) and Ojofeitimi et al.\cite{38} who investigated the dental caries status of 180 Nigerian elementary school children aged 8–15 years. This may be due to lack of awareness, affordability, or underutilization of dental care facilities by the children in the government schools.\cite{9} The socioeconomic conditions definitely influence the health care seeking behavior as well as seeking care for preventive purposes.\cite{10}

In the present study, one surface fillings were required in 37.5% students of private schools followed by 38.7% in aided schools, 35.5% in government schools and there was no statistically significant difference them ($P > 0.05$). Extraction was required in 0.5% of the students in aided schools, 2.1% in government schools, whereas none required extractions in private schools and there was a statistically significant difference between the groups ($P < 0.05$). Prosthetic rehabilitation was required in 4.8% of the students in government schools, 1% in aided schools, whereas none required prosthetic rehabilitation in private schools and there was a statistically significant difference between the groups ($P < 0.05$). The study results are similar to a study conducted by Shailee et al.\cite{9} to assess dental caries among school children in Shimla, where the treatment needs were higher in government schools compared to private schools. This may be due to the lack of awareness, affordability, or underutilization of dental care facilities by the children in the government schools.\cite{11,20}

In the present study, the dental caries prevalence was 46.8% in females and 44.4% in males but there was no statistically significant difference between them. The prevalence of filled teeth among males was 9.3% and 4.9% among females, and there was a statistically significant difference between them ($P < 0.008$). Similar findings have been reported by Misra and Shee,\cite{21} Mwakatobe and Mumghamba\cite{22} and Mosha et al.\cite{23} Findings from this study portray that females carries the biggest burden of dental caries that could be explained by their easy access to food supplies and their frequent snacking during food preparation. However, this is in direct contradiction with the findings by Vacher,\cite{24} Aukland and Bjelkaroe\cite{25} and Gaikwad and Indurkari\cite{26} who observed a higher caries experience in boys than in girls. However, Sudha et al.\cite{27} observed no statistically significant differences in the caries prevalence between the two sexes. The variation could be attributed to the different age groups and geographical location studies. Another study by Megas and Athanassouli\cite{28} showed the prevalence of caries to be more in cases of girls than the boys. The authors further stated that this may be because in girls the permanent tooth erupts earlier than the boys and therefore are exposed to the oral environment for a longer time.

In this study, 36.2% of males and 38.8% of females required one surface filling while 16.4% of males and 18.4% of females required more than one surface filling but the difference was not statistically significant ($P > 0.05$). Pulp care was required in 8.9% of males and 5.3% of females and extraction was required in 0.2% of males and 0.16% of females and the difference was statistically significant ($P < 0.05$). According to the National Oral Health Survey 2002–2003\cite{29} in India, among the 15 years old, one or more surface fillings were required in 60.2% of males and 57.9% of females, pulp care was required in 5.35% of males and 5.4% of females and extractions were required in 4.6% males and 3.8% females. According to a study carried out by Hegde and Shenoy\cite{10} to evaluate the dentition status and treatment needs among 15-year-old school children it was observed that there was no statistically significant difference between males and females among those who required one and more than one surface fillings similar to the findings of the present study. In a study conducted by Shailee et al.\cite{20} to assess the prevalence of dental caries and treatment needs among schoolchildren aged 15 years in Shimla city, it was found that 49.1% males and 51.6% of females required treatment which is similar to the findings of the present study.

In the present study, malocclusion was not present in 72.4% of students in private schools, 71% in aided schools and 66.2% in government schools indicating that treatment indication was higher in government schools, followed by aided and private schools, whereas none required one and more of surface fillings similar to the findings of the present study. In the present study, 70% of males and 69.2% of females had no malocclusion, 17.1% males and 15.1% of females had definite malocclusion, whereas 2.5% of males and 5.5% of females had handicapping malocclusion. The finding of the current study stated that there was no statistically significant difference between males and females ($P > 0.05$). These results are in accordance to the National oral health survey 2002–2003\cite{38} in India, where among the 15-year-old males 74.8% had no malocclusion, 16.8% had definite malocclusion, 3.9% had severe malocclusion and 4.5% had very severe malocclusion. In females, 77.3% had no malocclusion, definite malocclusion was present in 12.8%, severe malocclusion in 5.8% and very severe malocclusion in 4.1%.\cite{31} The results of the present study are in accordance with the study carried out.
by Hegde and Shenoy[10] among the 15-year-old school children of Mangalore, where 77.9% of males and 84% of females had no malocclusion, and there was no statistically significant difference between the two.

Conclusion

From the present study, we conclude that the school children aged 15 years attending private, aided and government schools of Mangalore had varied malocclusion status, dentition status, and treatment needs. The missing component and the filled component contributed very little to the total DMFT scores which indicate that there is a need for professional care. Teeth missing due to caries and those requiring extraction and prosthetic rehabilitation and malocclusion status and treatment need were more prevalent in government schools.

Screening or diagnostic programs for evaluation of oral health status should be carried out to identify and offer treatment to school going children. Preventive services should be given high priority, and it should be started at an early age to target future caries in permanent dentition. A comprehensive community-focused oral health care intervention that includes oral health education in schools, preventive, and treatment programs should be implemented and strengthened to improve the oral health status of the school children in Mangalore.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Kumar DA, Varghese RK, Chaturvedi SS, Agraval A, Fating C, Makkad RS. Prevalence of malocclusion among children and adolescents residing in orphanages of Bilaspur, Chhattisgarh, India. J Adv Oral Res 2012;3:21-8.
2. Saravanam S, Madivanam I, Subashini B, Felix JW. Prevalence pattern of dental caries in the primary dentition among school children. Indian J Dent Res 2005;16:140-6.
3. Mahesh Kumar P, Joseph T, Varma RB, Jayanthi M. Oral health status of 5 years and 12 years school going children in Chennai city – An epidemiological study. J Indian Soc Pedod Prev Dent 2005;23:17-22.
4. Moses J, Rangeeth BN, Gurunathan D. Prevalence of dental caries, socio-economic status and treatment needs among 5 to 15 year old school going children of Chidambaram. J Clin Diagn Res 2011;5:146-51.
5. de Almeida AB, Leite IC. Orthodontic treatment need for Brazilian schoolchildren: A study using the Dental Aesthetic Index. Dental Press J Orthod 2013;18:103-9.
6. Mutya M, Brudvik P, Aström AN. Prevalence of malocclusion and its relationship with socio-demographic factors, dental caries, and oral hygiene in 12- to 14-year-old Tanzanian schoolchildren. Eur J Orthod 2009;31:467-76.
7. Bhardwaj VK, Veeresha KL, Sharma KR. Prevalence of malocclusion and orthodontic treatment needs among 16 and 17 year-old school-going children in Shimla city, Himachal Pradesh. Indian J Dent Res 2011;22:556-60.
8. Shailee F, Girish MS, Kapil RS, Nidhi P. Oral health status and treatment needs among 12- and 15-year-old government and private school children in Shimla city, Himachal Pradesh, India. J Int Soc Prev Community Dent 2013;3:44-50.
9. Hegde V, Shenoy R. Dentition status, treatment needs and malocclusion status among 15 year old school children of Mangalore – A pilot study. J Indian Dent Assoc 2010;12:568-9.
10. Bali RK, Mathur VB, Talwar PP, Chanana HB. National Oral Health Survey and Fluoride Mapping. New Delhi: Dental Council of India; 2004.
11. Rodrigues JS, Damle SG. Prevalence of dental caries and treatment need in 12-15 year old municipal school children of Mumbai. J Indian Soc Pedod Prev Dent 1998;16:31-6.
12. Kulithamal SS, Deshpande SD. Caries prevalence and treatment needs in 11-15 year old children of Belgaum city. J Indian Soc Pedod Prev Dent 2002;20:12-5.
13. Shivakumar K, Chandu G, Shafulia M. Severity of malocclusion and orthodontic treatment needs among 12- to 15-year-old school children of Davangere district, Karnataka, India. Eur J Dent 2010;4:298-307.
14. Okullo I, Aström AN, Haugejorden O, Rwenyonyi CM. Variation in caries experience and sugar intake among secondary school students in urban and rural Uganda. Acta Odontol Scand 2003;61:197-202.
15. David J, Wang NJ, Aström AN, Kuriakose S. Dental caries and associated factors in 12-year-old schoolchildren in Thiruvananthapuram, Kerala, India. Int J Paediatr Dent 2005;15:420-8.
16. de Almeida CM, Petersen PE, André SJ, Toscano A. Changing oral health status of 6- and 12-year-old schoolchildren in Portugal. Community Dent Health 2003;20:211-6.
17. Taani DQ. Caries prevalence and periodontal treatment needs in public and private school pupils in Jordan. Int Dent J 1997;47:100-4.
18. Ojofetimmi EO, Hollist NO, Banjo T, Adu TA. Effect of cariogenic food exposure on prevalence of dental caries among fee and non-free paying Nigerian schoolchildren. Community Dent Oral Epidemiol 1984;12:274-7.
19. Shahapur R. Dentition status and treatment needs among school going children of Bijapur City, Karnataka, India. Int J Curr Res Rev 2012;4:118-23.
20. Goel P, Schgal M, Mittal R. Evaluating the effectiveness of school-based dental health education program among children of different socioeconomic groups. J Indian Soc Pedod Prev Dent 2005;23:131-3.
21. Misra FM, Shee BK. Prevalence of dental caries in school going children in an urban area of south orissa. J Indian Dent Assoc 1979;51:267-70.
22. Mwakatobe AJ, Mumghamba EG. Oral health behaviour and prevalence of dental caries in Dar- es- Salaam. Tanzania Dent J 2007;14:1-7.
23. Mosha HJ, Senkoro AR, Masalu JR, Kahabuka F, Mandari G, Mabelya L, et al. Oral health status and treatment needs among Tanzanian of different age groups, Tanzania. Tanzania Dent J 2005:12:18-27.
24. Vacher BR. Dental survey of school children in Amritsar (Punjab). J Indian Dent Assoc 1952;24:13.
25. Aukland S, Bjelkaroey J. The dental health of school children in Betul district Madiya Pradesh. J Indian Dent Assoc 1982;54:367-9.
26. Gaikwad RS, Indurkar MS. Prevalence of dental caries in school...
going children of Aurangabad in the year. J Indian Dent Assoc 1993;64:325-6.
27. Sudha P, Bhasin S, Anegundi RT. Prevalence of dental caries among 5-13-year-old children of Mangalore city. J Indian Soc Pedod Prev Dent 2005;23:74-9.
28. Megas BF, Athanassouli TN. Dental caries prevalence in the permanent teeth in Greek schoolchildren related to age, sex, urbanization and social status. Community Dent Health 1989;6:131-7.
29. Shailee F, Sogi GM, Sharma KR, Nidhi P. Dental caries prevalence and treatment needs among 12- and 15- year old schoolchildren in Shimla city, Himachal Pradesh, India. Indian J Dent Res 2012;23:579-84.
30. Batwala V, Mulogo EM, Arubaku W. Oral health status of school children in Mbarara, Uganda. Afr Health Sci 2007;7:233-8.
31. Sánchez-Pérez L, Irigoyen-Camacho ME, Molina-Frechero N, Mendoza-Roaf P, Medina-Solis C, Acosta-Gío E, et al. Malocclusion and TMJ disorders in teenagers from private and public schools in Mexico city. Med Oral Patol Oral Cir Bucal 2013;18:e312-8.