DMFT index assessment, plaque pH, and microbiological analysis in children with special health care needs, India

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Abstract

Aim: To assess the DMFT index of children with Special Health Care Needs (SHCN) in Navi Mumbai. To correlate the DMFT index with Streptococcus mutans count in the supragingival bacterial biofilm and with plaque pH.

Materials and Methods: Dental examination of 158 patients aged 5–18 years was conducted to determine the DMFT/dmft index. Supragingival plaque samples were collected from the buccal surfaces of all teeth. The samples were inoculated in mitis salivarius bacitracin agar medium and incubated at 37°C for 48 h. Supragingival plaque was collected from interproximal sites of the molar area (preferably mandibular) for conducting plaque pH test. Chi-square test and Pearson’s correlation were used to find the significance of the study parameters on categorical scale between the two groups.

Results: The mean DMFT recorded was 4.90 ± 4.63 and the mean dmft recorded was 1.77 ± 3.14. Mean number of S. mutans colony-forming units found was 2.961 × 10⁴. Mean plaque pH recorded was 6.2. Conclusion: No statistically significant correlation was found between the DMFT index with the number of S. mutans and plaque pH.

Key words: DMFT/dmft, plaque pH, Streptococcus mutans

INTRODUCTION

Oral health positively affects the physical and mental well-being, appearance, and interpersonal relations of an individual. It is thus a vital component of overall health, which contributes to each individual’s well-being and quality of life. Oral health is all the more important for children with special health needs. Because oral hygiene affects one’s esthetics, it has strong biological, psychological, and social projections.¹ People with disabilities deserve the same opportunities for oral health and hygiene as those who are healthy. Unfortunately, oral health care is one of the greatest unattended health needs of the disabled people.² The disabled population constitutes a substantial section of the community and it is estimated that there are about 500 million people with disabilities worldwide. The National Sample Survey Organisation (NSSO) report suggests that the number of disabled persons in India is estimated to be 18.49 million, accounting for about 1.8% of the total population, while the mentally retarded population amounts to 0.44 million individuals.³

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Dental caries and periodontal disease appear earlier in patients with physical and mental disabilities than in non-disabled patients.\(^{4,5}\) Although poor oral health status is seen in all mentally disabled people, the most significantly affected are the cerebral palsy and severe mental retardation (MR) group. The inability to maintain adequate oral hygiene may explain the high incidence of the oral diseases found in this population.\(^{6-8}\) However, other conditions must be added to the intellectual deficit and impaired motor skills, such as mouth breathing, occlusion abnormalities, bruxism, cariogenic diet, mastication deglutition dysfunction, abnormal tension of orofacial muscles, reduced salivary flow, and effect from medications. Furthermore, these individuals usually belong to low socioeconomic status, which aggravates the situation.\(^9\)

Not only oral hygiene but also dietary habits have been known to influence dental health. A significant association has been found between the frequency of consumption of sweets and high levels of dental caries.\(^{10}\) Concerned about disability of their children, parents and caregivers are more likely to allow consumption of sweets by them at smaller intervals between meals. This creates an environment that promotes the growth and prevalence of cariogenic microorganisms such as *Streptococcus mutans*.

The poor oral hygiene of disabled individuals, in comparison with age-matched non-disabled groups, has been widely reported.\(^{11-15}\) Hence, the present study was conducted to assess the DMFT index of children with Special Health Care Needs (SHCN) in Navi Mumbai, India and also to correlate the same with *S. mutans* count in the supragingival bacterial biofilm and with plaque pH.

**MATERIALS AND METHODS**

**Subjects**

After obtaining approval from the Institutional Review Board (IRB) – Ethics Committee, 158 patients of 5–18 years of age were included in this study. Written informed consent was obtained from one of their parents or the legal guardian before enrollment in the study. Study subjects were individuals with Down’s syndrome, autism, cerebral palsy, mild MR, moderate MR, severe MR, and hearing impairment, who were attending special schools in Navi Mumbai.

**Dental examination**

Dental examination was conducted after air-drying the teeth, under natural light, and with the aid of a dental mirror and explorer. All teeth were evaluated according to the criteria recommended by the World Health Organization (WHO) using the “dmft” and “DMFT” index for primary and permanent teeth, respectively.

**Collection of plaque samples**

*S. mutans* count

Supragingival plaque was collected from the buccal surfaces of all maxillary and mandibular teeth using a sterile swab (HIMEDIA, Mumbai, India). Immediately after sample collection, the swab was placed in a sterile tube containing 1 ml of phosphate-buffered saline. The sterile tubes were transported immediately to the microbiology laboratory for further analysis.

These plaque samples were then dispersed with a sterile, 3.5–4.5-mm-diameter micro loop on an agar plate containing mitis salivarius bacitracin (MSB) agar. This was followed by incubation at 37°C for 48 h, following which the colonies with *S. mutans* characteristics were counted using a manual method. *S. mutans* were identified following the standards described for the MSB agar [Figure 1]: Opaque and firm colonies that do not disintegrate when touched with a platinum needle, easily displaced, surrounded by a milky white halo, and with a scintillating droplet of polysaccharide frequently present on the top.\(^{15}\)

pH

Supragingival plaque was collected from the interproximal sites of the molar area (preferably mandibular) using plaque collector of the plaque pH indicator kit supplied by GC Asia (Hyderabad, India). In case of absence of mandibular molar, buccal surface of canine and premolar or labial surface of incisors

![Image](image_url)
was used for sample collection. Prior to collecting the plaque sample, gentle air-drying was done to reduce the risk of contamination with saliva. The plaque collector with attached plaque was dipped in plaque pH indicator solution for 1 s and left to ferment for 5 min. After 5 min, the pH was measured by checking the color and comparing with the chart on the dispensing dish, supplied with the plaque pH indicator kit (GC Asia) [Figure 2 and 3].

Chi-square test and Pearson’s correlation were used to find the significance of the study parameters on categorical scale between the two groups. Significance level was set at 5% for all analyses.

RESULTS

Of the total 220 disabled children and adolescents attending the special schools in Navi Mumbai, 158 (71.81%) were examined. The remaining children were either absent from school for a long period of time or highly uncooperative and very difficult to examine, whereas some parents and guardians were unwilling to give consent for the participation of their children in the present study.

The study showed an unequal gender distribution, with males comprising 69% of the total sample. The subjects were divided into eight groups depending upon the type of disability as follows: Down’s syndrome (20.9%), autism (10.1%), cerebral palsy (3.8%), mild MR (23.4%), moderate MR (21.5%), severe MR (14.6%), and deaf (5.7%).

Table 1 shows strong statistical significance ($P < 0.001$) in mean DMFT score among the various types of disabilities, with the highest and lowest mean for Down’s syndrome (7.24 ± 5.96) and hearing impairment (1.67 ± 4.637), respectively. However, there was no statistical significance ($P = 0.142$) in mean dmft score among the various types of disability. Table 2 shows statistical significance between dmft and $S. mutans$ count in association with severe MR group ($P = 0.037$) only, whereas no significant results were found in other groups. Table 2 also shows no statistical significance in association between DMFT and $S. mutans$ count. Table 3 shows no statistical significance between dmft and plaque pH levels and between DMFT and plaque pH levels.

DISCUSSION

The beginning and progression of dental caries is influenced by bacterial, dietary, environmental, and socioeconomic factors. Significant indicators of caries risk are: Past caries experience, salivary and plaque concentration of $S. mutans$ and lactobacilli, along with the presence of protective factors like the buffering capacity of saliva. Imbalance between protective and risk factors results in selective growth of specific microorganisms ($S. mutans$ and lactobacilli), which are the main acidogenic and aciduric organisms associated with dental caries.

Quality oral health care contributes to holistic health, which should be a right rather than a privilege. Unfortunately, it has been extensively demonstrated over time and worldwide, including in India, that there is a lack of dental care to patients with special needs. Individuals with disabilities also deserve the same opportunities for dental services as those who are healthy. Therefore, this study was conducted to assess DMFT/dmft among different types of children going to special schools.
Table 1: Mean score DMFT and dmft among various types of disabilities

| Variables                  | Down's syndrome | Autism | Cerebral palsy | Mild MR | Moderate MR | Severe MR | Hearing impairment |
|----------------------------|-----------------|--------|----------------|---------|-------------|-----------|-------------------|
| DMFT (mean)                | 7.24±5.69       | 3.56±3.010 | 5.50±3.32     | 3.59±4.298 | 4.03±5.099  | 6.96±4.301  | 1.67±4.637        |
| dmft (mean)                | 1.48±3.242      | 1.38±2.391 | 3.67±2.582    | 1.69±3.416 | 1.18±2.096  | 2.00±3.205  | 4.22±5.118        |

*Statistically significant correlation (P<0.05). MR=Mental retardation, DMFT= Decayed missing filled teeth

Table 2: Spearman correlation of DMFT, dmft versus S. mutans among various types of disabilities

| Pair                        | Down's syndrome | Autism | Cerebral palsy | Mild MR | Moderate MR | Severe MR | Hearing impairment |
|-----------------------------|-----------------|--------|----------------|---------|-------------|-----------|-------------------|
| DMFT vs S. mutans           | r=0.125;        | r=0.172; | r=0.338;      | r=0.263; | r=0.075;    | r=0.072;  | r=0.023;          |
|                             | P=0.487         | P=0.525 | P=0.612       | P=0.115  | P=0.672     | P=0.742   | P=0.953           |
| dmft vs S. mutans           | r=0.265;        | r=0.306; | r=0.750;      | r=0.127; | r=0.160;    | r=0.436;  | r=0.636;          |
|                             | P=0.136         | P=0.246 | P=0.086       | P=0.405  | P=0.366     | P=0.037*  | P=0.066           |

*Statistically significant correlation (P<0.05). MR=Mental retardation, DMFT= Decayed missing filled teeth

Table 3: Spearman correlation of DMFT, dmft versus plaque pH among various types of disabilities

| Pair                        | Down's syndrome | Autism | Cerebral palsy | Mild MR | Moderate MR | Severe MR | Hearing impairment |
|-----------------------------|-----------------|--------|----------------|---------|-------------|-----------|-------------------|
| DMFT vs plaque pH           | r=0.012;        | r=0.045; | r=0.000;      | r=0.165  | r=0.163;    | r=0.066;  | r=0.534;          |
|                             | P=0.946         | P=0.870 | P=1.000       | P=0.928  | P=0.368     | P=0.763   | P=0.138           |
| dmft vs plaque pH           | r=0.163;        | r=0.503 | r=0.002;      | r=0.105; | r=0.211;    | r=0.587;  | r=0.096           |
|                             | P=0.366         | P=0.255 | P=0.312       | P=0.892  | P=0.554     | P=0.333   | P=0.066           |

MR=Mental retardation, DMFT= Decayed missing filled teeth

It is evident that the caries experience of the disabled subjects who were attending special schools was higher than that of children attending regular schools as per the National Oral Health Surveys. In the present study, highest DMFT score was reported in Down’s syndrome (7.24 ± 5.69), followed by severe MR (6.96 ± 4.301), cerebral palsy (5.50 ± 3.32), moderate MR (4.03 ± 3.099), mild MR (3.59 ± 4.298), autism (3.56 ± 3.010), and hearing impairment (1.67 ± 4.637). The high DMFT scores among children with Down’s syndrome could be due to the lack of awareness about dental visits, irregular dietary habits, inadequate oral hygiene measures, lack of fluoridated water, easy availability of cheap food containing high amount of sucrose, parental neglect, and lack of initiative toward prevention as well as child’s inability to verbalize their problems. We also found that children with Down’s syndrome were more prone to be weaned off bottled milk at an older age or were given syrup-based medicines for repeated infections because of swallowing problems. Similarly, highest dmft was found with hearing impairment (4.22 ± 5.118), followed by cerebral palsy (3.67 ± 2.582), severe MR (2.00 ± 3.205), mild MR (1.69 ± 3.416), Down’s syndrome (1.48 ± 3.242), autism (1.38 ± 2.391), and moderate MR (1.18 ± 2.096) in our study. These results were in accordance with the studies conducted by Shyama et al. and Asokan et al. However, the finding of the present study differed from the studies conducted by Barnett et al. and Davidovich et al. who reported less DMFT in children with Down’s syndrome when compared to healthy children.

Clinical studies have shown that caries is associated with increase in the proportions of acidogenic and aciduric bacteria, especially mutants streptococci (such as S. mutans and Streptococcus sobrinus) and lactobacilli, which are capable of demineralizing enamel.

These bacteria can rapidly metabolize dietary sugars to acid, creating a low pH environment locally. This low pH environment becomes the survival advantage of these species. The other species of oral microflora are sensitive to low pH and cannot survive in it. Among the acidogenic and aciduric microflora, S. mutans has been strongly implicated with dental caries.

The persistent pH drop in plaque after exposure to fermentable dietary carbohydrates can be due to the metabolic activity of increased number of acidogenic...
and aciduric bacteria on the tooth surfaces. These are particularly efficient carbohydrate fermenters such as *S. mutans* or *S. sobrinus*.

In the present study, all patients had *S. mutans* in their dental biofilm and the number ranged from $2.0 \times 10^4$ to $1.75 \times 10^5$. Half of the study population had *S. mutans* colony-forming unit (CFU) levels higher than $10^5$. The above facts were also confirmed by the results of the present study wherein we found a positive association between dmft and *S. mutans* level in severe MR and hearing impairment. However, we could not find any statistical significance between DMFT and various types of disabled children. This is in accordance with the results of the study conducted by Tanaka *et al.*[15]

Several investigations have tried to associate *S. mutans* colonization levels with dental caries incidence, but there are very few studies done on institutionalized disabled persons. In patients with MR, caries incidence and the amount of bacteria in the dental biofilm seem to be higher than the average for the general population. Sánchez-Pérez *et al.*[14] verified an association between the *S. mutans* counts from the dental biofilm and the DMFT index and surfaces with active caries. The authors reported that 18 months after the initial examination, 86% of the children at high risk developed multiple carious lesions, while 94% of the children at low risk developed few or no lesions. Linear regression analysis identified *S. mutans* from the dental biofilm as the most significant bacteriological indicator for DMFT. Matee *et al.*[28] found a significant relationship between *S. mutans* levels and dental caries index, but they also observed high levels of this microorganism in children who did not present carious lesions, which suggests that the presence of cariogenic bacteria does not necessarily mean high caries activity as this is a multifactorial pathology. In accordance with the findings of Matee *et al.*,[28] we also found high *S. mutans* CFU counts in patients with low or absent DMFT in our study. There was significant correlation between *S. mutans* CFU and the number of decayed teeth, but no correlation was found between *S. mutans* CFU and the DMFT index. Likewise, Llena-Puy *et al.*, [29] while studying the relationship between dental caries and *S. mutans* and lactobacilli CFU, buffering capacity of the saliva, and salivary flow in school children, did not find a statistically significant correlation between DMFT index and the bacterial count.

According to several authors,[16,29‑32] the presence of decayed teeth significantly increases *S. mutans* count in saliva and dental biofilm, as they provide the ideal niche for these bacteria. Even in our study, the number of decayed teeth was the highest contributing factor to DMFT score.

In the present study, the majority of the candidates had plaque pH below 6. However, statistically significant association between dmft and plaque pH was found only in children disabled with hearing impairment. The possible reason for this could be improper or delayed onset of communication skills among them.

**CONCLUSION**

In this study, collection of dental biofilm was done to determine the CFU of microorganisms. This study reveals only a single juncture of a chronic, multifactorial and dynamic disease. In addition, the bacteria involved in dental caries vary in response to changes in the oral environment. Similar studies should be undertaken in future to develop a baseline data for better understanding the dynamics of caries in children with SHCN, which may help to guide and modify current and future oral health prevention activities. A preventive dentistry program is recommended involving parents, teachers, and specialized dental team to look after the oral health needs of the disabled population.

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**Conflicts of interest**

There are no conflicts of interest.

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