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Original Article

DMFT index assessment and microbiological analysis of *Streptococcus mutans* in institutionalized patients with special needs

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Abstract

Aim: To assess the DMFT (D = decayed; M = missing; F = filled) index of institutionalized patients with mild and moderate physical and mental disabilities and to correlate it with the *Streptococcus mutans* (*S. mutans*) counts in the supragingival bacterial biofilm. **Methods**: Dental examination of 28 patients aged 15 to 25 years was conducted to determine the DMFT index (number of decayed, missing and filled teeth). Supragingival plaque samples were collected from the buccal surfaces of all teeth. The samples were inoculated in SB20 medium and incubated at 37 °C for 48 hours. Spearman's correlation test was applied ($p = 0.05$) to evaluate the correlation between the DMFT index and the amount of *S. mutans*. **Results**: The mean DMFT recorded was 7.68 and a large mean number of *S. mutans* colony-forming units (cfu > 10^6) was found. No statistically significant correlation was found between the DMFT index and the number of *S. mutans*. **Conclusions**: Under the conditions of this study, no correlation was found between the DMFT index and the number of *S. mutans* cfu in institutionalized patients with mental retardation and physical disabilities.

Keywords: *Streptococcus mutans*, disabled persons, dental caries.

Introduction

Dental caries and periodontal disease appear earlier in patients with physical and mental disabilities than in non-disabled patients[1,2]. The inability to perform adequate oral hygiene may explain the high incidence of the oral diseases found in this population[3-5]. However, other conditions must be added to the intellectual deficit and impaired motor skills, such as mouth breathing, occlusion abnormalities, bruxism, cariogenic diet, mastication and deglutition dysfunction, abnormal tension of facial muscles, reduced salivary flow and effects from medications[1]. Furthermore, these individuals usually have low socioeconomic level, which aggravates the situation[2,6].

Not only oral hygiene but also dietary habits have been known to influence the dental health. A significant association has been found between the frequency of consumption of sweets and high levels of dental caries[7]. Concerned about disabled persons, parents and caregivers are more likely to allow consumption of sweets and a smaller interval between meals,

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thus creating an environment that promotes the growth and prevalence of cariogenic microorganisms, such as *Streptococcus mutans* (*S. mutans*).

Because of the difficulty in carrying out motor activities, including mastication and toothbrushing, individuals with neuropathies prefer a pureed or pasty diet, which is more cariogenic[8]. In most cases, proper oral hygiene is done by parents or caregivers, but they report difficulties because disabled persons are usually non-cooperative with this activity[2,9].

Although the basic health, social, psychological and educational needs of these disabled patients are identical to those of non-disabled individuals, the oral health of patients with special needs is still very poor. The main reasons that lead to this situation are the absence of specialized centers with trained dentists[10,11] and, most of all, the family's lack of education, motivation and interest regarding oral homecare. This fact is aggravated by the low socioeconomic and cultural level of the family[2]. In order to achieve collaboration through good oral hygiene, it is necessary to establish a solid relationship between dentist, patient and their parents or caregivers. This interchange that involves motivation, education and especially willpower, is harder to be achieved for institutionalized patients, because there is no emotional involvement with the caregiver.

Knowledge of the clinical and microbiological characteristics of caries disease in disabled patients may allow the rational establishment of educational and preventive measures that contribute to improve oral health and, consequently, the general health of this population. Therefore, the purposes of this study were to assess the DMFT (D = decayed; M = missing; F = filled) index of institutionalized patients with mild and moderate physical and mental disabilities and to correlate the DMFT index with the *S. mutans* counts in the supragingival bacterial biofilm.

Table 1. Medication in use, number of *S. mutans* colony-forming units (cfu), number of decayed, missing and filled teeth and the DMFT index for each patient

Patient	Medication	cfu	Decayed	Missing	Filled	DMFT
1	Anticonvulsant and antipsychotic	4.0×10^5	0	0	6	6
2	-	7.2×10^4	2	4	7	13
3	-	7.6×10^4	1	0	3	4
4	-	2.8×10^6	2	0	3	5
5	-	2.8×10^5	1	1	12	14
6	-	8.0×10^5	0	3	5	8
7	Anticonvulsant and neuroleptic	6.0×10^5	9	0	0	9
8	Antipsychotic and neuroleptic	1.2×10^6	0	2	3	5
9	Anticonvulsant	7.0×10^4	1	1	3	5
10	-	2.0×10^6	1	5	0	6
11	Anticonvulsant and antidepressant	2.08×10^5	0	3	9	12
12	Anticonvulsant	6.6×10^5	4	1	0	5
13	-	4.4×10^6	5	0	0	5
14	-	3.6×10^4	1	0	0	1
15	Anticonvulsant	1.48×10^7	2	6	0	8
16	-	4.0×10^5	0	0	6	6
17	-	2.8×10^5	1	1	3	5
18	Neuroleptic	2.14×10^6	1	2	13	16
19	Anticonvulsant	7.4×10^6	1	0	0	1
20	Anticonvulsant	7.2×10^5	1	2	5	9
21	Neuroleptic	2.4×10^6	1	1	4	6
22	Neuroleptic	3.6×10^6	1	4	11	16
23	-	6.6×10^7	3	6	1	10
24	Anticonvulsant	9.4×10^5	3	0	6	9
25	Anticonvulsant, antipsychotic and neuroleptic	5.64×10^7	2	0	9	11
26	-	1.28×10^6	13	0	0	13
27	-	1.12×10^6	2	0	6	8
28	-	6.8×10^4	0	0	0	0

Material and methods

Subjects

After approval of the research project by the Research Ethics Committee of the Dental School of Araraquara, Universidade Estadual Paulista "Júlio de Mesquita Filho" (Unesp), 28 patients aged 15 to 25 years were enrolled in this study. Written informed consent was obtained from at least one of their parents or legal guardians, before enrollment in the study. Participants were individuals institutionalized in an institution for mentally disabled persons who presented diagnosis of mild to moderate physical and mental disabilities and were taking anticonvulsant, antipsychotic, neuroleptic and antidepressant medication (**Table 1**). The participants had not made use of antibiotics for at least three month before the investigation.

Dental examination

Dental examinations were conducted after teeth were air-dried, under artificial light and with the aid of a dental mirror and explorer. The number of teeth was recorded for each patient. All erupted teeth were evaluated according to the criteria recommended by the World Health Organization (WHO)[12] using the DMFT index for permanent teeth.

Plaque samples

Supragingival plaque samples were collected from buccal surfaces from all maxillary and mandibular teeth using a sterile swab before

toothbrushing. Immediately after sample collection, the swab was placed in a sterile tube containing 1 mL saline. The plaque samples of each patient were dispersed by vortexing with sterile 3.5 to 4.5-mm diameter glass beads for 30 seconds to disperse bacterial segregates and were diluted in decimal series from 10^{-1} to 10^{-4} in 0.15 M saline. Aliquots of each dilution were inoculated in bacitracin sucrose agar/SB-20 for *S. mutans* and then incubated at 37 °C for 48 hours. After this period, the colonies with *S. mutans* characteristics were counted using a stereoscopic microscope (model Citoval, RDA, Carl Zeiss Jena, Germany) with 10x magnification and a digital colony counter (Phoenix CP 600 Plus; Phoenix Indústria e Comércio de Equipamentos Científicos Ltda., Araraquara, SP, Brazil). *S. mutans* were identified following the standards described for the SB-20 medium: 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 on the top frequently present.

Spearman's correlation was used to evaluate the correlation between DMFT index and the *S. mutans* counts in the supragingival bacterial biofilm. Significant level was set at 5% for all analyses.

Results

The data obtained in the clinical examination and in the microbiological analysis are presented in **Table 1**. The mean DMFT of the study population was 7.68, with a mean number of decayed, missing and filled teeth of 2.07, 1.5 and 4.11, respectively (**Table 2**). The F component was therefore the one that most contributed to the high DMFT. **Table 2** also shows that the individuals presented a high *S. mutans* colony-forming units count (cfu > 10^6).

There was no correlation between the DMFT index and the number of *S. mutans* cfu. There was a weak positive correlation (r = 0.389; p = 0.041) between the number of *S. mutans* cfu and the number of decayed teeth (D) (**Table 3**).

Table 2. Mean number of *S. mutans* colony-forming units (cfu), mean number of decayed, missing and filled teeth and mean DMFT index for the studied population (n = 28)

	cfu	Decayed	Missing	Filled	DMFT
Mean	6.1×10^6	2.07	1.5	4.11	7.68
Standard deviation	1.6×10^7	2.85	1.93	3.98	4.3

Table 3. Correlation between the number of *S. mutans* colony-forming units (cfu) and the number of decayed, missing and filled teeth and the mean DMFT index for the studied population (n = 28)

	Decayed	Missing	Filled	DMFT
Correlation coefficient	0.389*	0.175	-0.057	0.245
Significance	0.041	0.372	0.775	0.209

* Statistically significant correlation ($p < 0.05$).

Discussion

The beginning and progression of dental caries are influenced by several risk factors, including bacterial, dietary, environmental and socioeconomic factors. The most significant indicators of caries risk are past caries experience, concentration of *S. mutans* and *Lactobacilli*, and the presence of protective factors like the buffering capacity of saliva[13]. An unbalance between protective and risk factors results in growth of specific microorganisms (*S. mutans* and *Lactobacilli*), which are part of the human dental biofilm[14] and are considered the main acidogenic and aciduric organisms associated with dental caries[14-16].

The DMFT index is one of the most widely used indices for presenting epidemiological data about the caries experience of a population. However, this index relates to past signs of the disease, since it allows verifying the incidence or prevalence of decayed, missing and filled teeth, but does not reveal if the caries disease is active or not.

In this study, the mean DMFT was 7.68 and we considered for analysis the active white spot lesions. Rodríguez-Vázquez et al.[5] found a mean DMFT of 5.97 among 20 to 40-year-old institutionalized adult patients with mild to moderate mental retardation; the majority of whom (70.4%) participated in a preventive program that included weekly mouthrinses with a 0.2% fluoride solution and use of a fluoride dentifrice.

Unfortunately, it has been extensively demonstrated over time and worldwide, including in Brazil, that there is a great lack of dental care to patients with special needs[1,11,17-19]. These studies reported a DMFT of 17.4 in patients aged 17 to 24 years, in which 90% of them needed restorations and presented poor oral hygiene and periodontal disease[11]; DMFT of 4.4 in patients aged 11 to 14 years, almost 74% of whom presented carious lesions[17]; DMFT of 7.92 in 25-year-old adults, with the D component reflecting many untreated decayed teeth[18] and 88% of the patients needing conservative treatment[19]. Rodrigues dos Santos et al.[1] studied dental caries in Brazilian patients with cerebral palsy and observed high DMFT and biofilm indices. These outcomes suggest that this population belong to a group that is at high caries risk and require preventive oral health measures. In the present study, since the patients attended a dental care program, the component that most contributed to the high DMFT was filled teeth (F).

Several investigations have tried to associate *S. mutans* colonization levels with dental caries incidence, but there are few studies with institutionalized disabled persons. In patients with mental retardation, 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.[13] verified an association between the *S. mutans* counts from 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.[20] 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.[20], this study also found high *S. mutans* cfu counts in patients with low or absent DMFT. 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.[21], 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 the DMFT index and bacterial count.

According to several authors[13,22-25], the presence of decayed teeth increases significantly *S. mutans* counts in saliva and dental biofilm. Petti et al.[24] pointed out that when these teeth are restored, the concentration of these microorganisms fall to levels similar to those found in health individuals, reducing the risk of infecting other teeth. Since the number of restored teeth was the component that most contributed to the high DMFT found in this study, the absence of correlation between *S. mutans* cfu and the DMFT index can be explained.

In the present study, all patients had *S. mutans* in their dental biofilm and the number ranged from $3.6x10^4$ to $6.6x10^7$. Half of the study population had *S. mutans* cfu levels higher than 10^6. Spearman's rank correlation coefficient ($r = 0.389$) revealed a significant but weak positive correlation between *S. mutans* and decayed teeth ($p < 0.05$). This can be explained by the fact that *S. mutans* has been strongly associated with the beginning of the caries process[26]. Even though this study did not find a significant correlation between the DMFT index (caries experience) and the number of *S. mutans* cfu, several studies have shown a highly significant relationship between these two factors, supporting the infectious nature of caries disease[15,21,27,28].

Studies such as this, in which only one collection of dental biofilm was done to determine the number of microorganisms present in the mouth, reveal a single moment of a multifactorial and dynamic disease that takes some time to develop. In addition, the bacteria involved in dental caries vary in response to changes in the oral environment. However, such studies are important as a base to develop preventive programs and to assess their success.

Under the tested conditions, a correlation between the DMFT index and the number of *S. mutans* cfu in institutionalized patients with mental retardation and physical disabilities was not found.

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