Dental and periodontal health status in children affected by cystic fibrosis in a southern Italian region

G.F. FERRAZZANO, S. ORLANDO, G. SANGIANANTONI, T. CANTILE, A. INGENITO

ABSTRACT: Aim The aim of this study was to record the oral health status through the mean value of the DMFT/dmft index, the CPITN values and the DDE modified index in children affected by cystic fibrosis (CF). Study design Observational study. Methods A group of 54 CF patients, aged 7 to 12 years, was selected and their data were compared to those of the same age healthy control group of 101 children. Results and statistics CF patients showed a mean DMFT (1.5 ± 2.17) and dmft (0.42 ± 0.9) significantly lower than control subjects (respectively 3.70 ± 3.92 and 2.96 ± 3.30). Moreover, in the CF subjects a high prevalence (55.6%) of enamel defects and a better periodontal health were found, despite the low presence of calculus in both groups. Conclusions The low caries experience and the high prevalence of enamel defects in CF patients could be due to the metabolic disease, and above all to the long-term pharmacological therapies (antibiotics and pancreatic enzymes) that they take.

Key words: Cystic fibrosis

Introduction

Cystic fibrosis (CF) is a hereditary disease that affects mainly lungs and the digestive system, causing progressive disability, and often early death. The disease is one of the most common life-shortening in Italy (1 in 3700 children was born with CF) [Tomaiuolo et al., 2008]. CF is caused by a mutation in the cystic fibrosis transmembrane conductance regulator gene, or CFTR. The product of this gene is a chloride ion channel important for the production of sweat, digestive juices, and mucus. Although most people without CF have two working copies of the CFTR gene, only one is needed to prevent cystic fibrosis. CF develops when neither gene works normally. Therefore, CF is considered an autosomal recessive disease [Damas et al., 2008].

In essence, the deletion causes increased mucoid secretions in every exocrine gland, including the salivary glands (sublingual in particular) [Aps and Martens, 2004].

Difficulties in breathing and insufficient pancreatic enzyme production are the most common symptoms. Thick mucus production, as well as a less competent immune system, results in frequent lung infections, which are treated, though not always cured, by oral and intravenous antibiotics and other medications [Weiner et al., 2008]. The symptoms of cystic fibrosis vary according to several factors, such as age, involvement of specific organs, prior therapies, and different types of previous infections. Cystic fibrosis affects the whole body, and impacts breathing, digestion, and reproduction. Other symptoms of CF appear during the remainder of childhood and early adulthood. These include continued problems with growth, the onset of lung disease, and increasing difficulties due to poor absorption of vitamins and nutrients by the gastrointestinal tract [Davies et al., 2007]. CF patients require many in-between meals, such as snack and sugar-rich drinks to provide the necessary source of energy. The high cariogenic potential of the diet and the daily use of antibiotics, as well as the disease itself, affect the oral environment and subsequently the dental health of CF patients [Jagels and Sweeney, 1975]. In current literature, the relationship between CF and oral health is quite discordant; in fact, while some studies show that CF patients have a lower caries experience than healthy controls and a higher tendency to form dental calculus [Primosch, 1980; Kinirons, 1989], on the other side, recent researches deny this relationship [Aps and Martens, 2004; Martens et al., 2001; Aps et al., 2001].

The subjects affected by mucoviscidosis show a high percentage of dental anomalies and reduced plaque levels [Dabrowska et al., 2006; Aps et al., 2002a; Aps et al., 2002b], with little gingivitis compared to healthy controls of the same age.
The aim of the present study was to assess: caries experience (DMFT/dmft), prevalence of enamel defects (modified DDE index), and treatment need (CPITN) of CF patients versus healthy controls in Campania region, Italy.

Materials and Methods
Fifty four children affected by cystic fibrosis (age range 7 to 12 years) were recruited from volunteer patients at the CF Center of the University Federico II of Naples (Italy), and compared to 101 healthy children randomly selected from 10 public schools of the Regional Campanian district. The ethical principles stated in the World Medical Association Declaration of Helsinki were followed in this study and all the parents of the children, after they were given verbal and written explanations of the experimental protocol and the study aims, gave written informed consent. Additionally, the study approval was requested and obtained by the ethical committee of the University Federico II of Naples. Inclusion criteria for the control group required that the children were from single live births, in good health (ASA I-II) (American Society of Anesthesiologists classification I-II) with or without history of dental care and did not assume fluoride.

Inclusion criteria for CF group required that children had cystic fibrosis and fluoride was not administered. Parents or guardians were approached by a trained interviewer who explained the aim of the study, its procedure and benefits. All caregivers gave their consent to participate.

All subjects were visited at the Paediatric Dentistry Department of the University Federico II of Naples. Clinical examinations were carried out by two professionals, in the same room and using the same dental unit (so that all patients were examined under the same lighting conditions) using a plane buccal mirror and the WHO ballpoint probe, with air drying when necessary. The presence of decay was assessed by systematical evaluation of each child’s caries experience using the DMFT/dmft index. A bitewing x-ray was also taken, to correctly detect dental decay. The thyroid collars for children and for the accompanying person, if assisting during x-ray exposures, were used. Pointing cone and dental films (Kodak Ultraspeed, Speed group D) were placed using a paediatric x-ray positioner. Bitewings radiographs were made for each child according to the European Academy of Paediatric Dentistry guidelines for use of radiographs in children [Espelid et al., 2003]. The CPITN index (Community Periodontal Index of Treatment Needs) was recorded using a WHO CPITN ballpoint probe on permanent maxillary right central incisor, permanent mandibular left central incisor, permanent mandibular left first molar and permanent mandibular right first molar surfaces, when possible, following the WHO indications [Ainamo et al., 1982]. The enamel defects were recorded using the modified DDE index (Developmental Defects of Enamel) [Commission on Oral Health Research & Epidemiology, 1992; Clarkson et al., 1989], trefore assessing the type (opacity, hypoplasia, discoloration), number (single and multiple), demarcation (demarcated and diffuse), and location of defects on the buccal and lingual surface of the teeth [Clarkson and O’Mullane, 1989] (Table 1).

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS 10.0 for Windows). The comparison of the DMFT/dmft mean between the two groups was carried out using one-way analysis of variance (ANOVA). Statistical significance was set at p = 0.05.

Results
The results showed that the mean value of DMFT was 1.5 ± 2.17 (Fig. 1) in the CF patients, and 3.70 ± 3.92 in the healthy subjects. Also in the primary teeth the CF children showed a dmft mean value of 0.42 ± 0.9, significantly lower than the value of the control group (2.96 ± 3.30) (p<0.001) (Fig. 2).

A meaningful difference was found in the presence of enamel defects among the two groups (p<0.001); in fact, 55.6% of the subjects affected by CF had enamel defects in comparison to 22.7% of the healthy subjects (Fig. 3). In detail, 42% of the CF patients had hypoplasia with loss of enamel, 30.4% had marked white/cream opacity, 14.4 % had marked yellow/brown opacity, 4.3 % had irregular diffused

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Table 1 - Modified DDE Index
opacity and 8.6% had hypoplastic enamel. Hypoplasia recorded for the control group showed the following results: loss of enamel, 8.7%; white/cream opacity, 39.1%; marked yellow/brown opacity, 8.7%, and irregular diffused opacity, 30.4%. The healthy group showed no hypoplasia pits. Data elaboration on the CPITN index showed no significant differences between the two group. The 62.4% of the CF subjects and the 48.6% of the controls exhibited a good periodontal status. Bleeding on probing was observed for 27.1% of the CF patients, and 41.4% of the control subject, while 10.5% of the CF children and 10% of the controls had calculus (Fig. 4).

**Discussion**

The results from this study showed that the DMFT mean value in subjects affected by CF was statistically lower (p<0.01) than in the control group; this difference was seen in the primary dentition. This assessment looks particularly interesting, since literature reported that children with CF had a high frequency of cariogenic food consumption due to ravenous appetites secondary to the presence of pancreatic insufficiency [Aps et al., 2002a]. Although the development of dental caries in an individual is a complex process related to a multitude of environmental and hereditary factors, the low caries prevalence in CF patients may be attributed to several factors common to these patients. It should be acknowledged that all CF patients examined in this study were administered pancreatic enzymes, and frequent aerosol antibiotic therapies, which could play an important role in the reduction of plaque levels [Narang et al., 2003; Littleton and White, 1964]. Furthermore, high levels of calcium and phosphorus have been reported in the sub-maxillary saliva of CF patients [Aps et al., 2002b]. Incorporation of salivary calcium and phosphate into the enamel may be a post-eruptive maturational process which confers to the tooth a greater resistance to demineralization. However, it must be considered that the mucoviscidosis, manifesting since birth, induces
parents to pay more attention toward the health status of their children. Moreover it should be underlined that the DMFT mean value found in the present study is lower compared to those found in the studies of Aps and Martens, both for the patients affected by cystic fibrosis (respectively 1.5±2.17 for the Italian group and 4.05±5.35 for the Belgian group) and for the healthy group (3.7±3.92 for the Italian group and 6.79±6.11 for the Belgian group) [Aps et al., 2002b]. The difference among the groups is always meaningful despite the improvements of DMFT values recorded in recent years among the Italian population.

In our study, CF patients have, besides, a better periodontal health, with respect to what happens in the same age control. No significant differences were found regarding in the presence of calculus between the two groups, only a very low percentage (10.5%) of CF subjects have a dental calculus, confirming what reported in literature [Littleton and White, 1964; Jagels and Sweeney, 1975; Dabrowska et al., 2006]. This data is due, probably, to the assumption of pancreatic enzymes, which prevent precipitation of calcium and phosphate [Sweeney and Shaw, 1965; Baumhammers et al., 1968; Kinirons, 1983]. It should be considered, however, that the young age of the patients plays a role on the level of calculus detected [Littleton and White, 1964; Kinirons, 1989]. The DDE index was higher in the CF subject compared to the controls, with demarcated and diffuse opacities, and hypoplasia defects. It is interesting to highlight that this study did not include defects of fluoride origin, as fluoride assumption was encompassed between the exclusion criteria.

It is likely that the high incidence of systemic enamel defects (55.6%) may be the result of the metabolic and nutritional disturbance, which are often superimposed in case of chronic disease such as CF [Azevedo et al., 2006; Sui et al., 2003]. Besides it should be remembered that CF patients (since birth) often assume antibiotics that can affect the dental development.

**Conclusion**

This study confirmed that the CF group has a significantly lower caries experience than the control group; additionally CF patients show a higher prevalence of enamel defects compared to healthy subjects, while in both groups there is a low presence of calculus with good periodontal health.

**References**


