

S. Cianetti, G. Lombardo, M. Bravi, S. Grandini*

Department of Surgical and Biomedical Sciences, Unit of Pediatric Dentistry, Medical School, University of Perugia, Italy

*Department of Biomedical Sciences, Unit of Endodontics and Restorative Dentistry, Dental School, University of Siena, Italy

e-mail: guido.lombardo@unipg.it

Is pit and fissure sealing of buccal surfaces useful in reducing incidence of caries of first permanent molars?

ABSTRACT

Aim The aim of the study was to establish whether caries prevalence on the buccal surfaces of first lower permanent molars (FLPMs) can be compared to those on the occlusal surfaces in order to justify the utility of extending pit and fissure sealing also to the extra-occlusal surfaces.

Materials and methods Design: an observational study was carried out in the children population ($n=779$) aged ≤ 14 years (mean age 7.68, SD 3.53) that presented at the Paediatric Dentistry Department of the University of Perugia. In the study were included 460 patients, and absolute frequency (number) of FLMP occlusal and buccal caries, together with their ratio and their difference in percentage, were recorded and analysed. Moreover, FLMP buccal caries variation related to age, sex and parent's nationality were calculated.

Results Among the 460 children included (243 males) aged 5-14 years, 103 erupted FLPMs were analysed. Of their decayed surfaces ($n=115$), the occlusal surfaces were 62 (53.9%) and the buccal surfaces 53 (46.1%); the absolute frequency ratio was 1.17 and the percentage difference was 7.8%. The female gender was significantly related to buccal caries of FLPMs [OR = 2.66 (95% CI; 1.27-5.59; $p=0.0096$)] as was the age ranging between 10-14 years [OR = 2.73 (95% CI; 1.36-5.50; $p=0.004$)] The parents nationality was not significantly related to buccal caries [Odds Ratio = 1.47

(95% CI; 0.70-3.06; $p = 0.9040$)].

Conclusions The similar caries susceptibility of buccal and occlusal surfaces of FLPMs stimulates further comparative studies about the usefulness of extending pit and fissure sealing to the buccal surfaces in addition to the occlusal prophylactic intervention, particularly with regard to the female sex and during the early eruption stages of these teeth.

Keywords Buccal caries; Extra-occlusal caries; First lower permanent molar; Pit and fissure sealing.

Introduction

Dental caries is the most common childhood disease, reaching a 50% prevalence rate in the childhood population [Lam, 2014], and first and second permanent molars are the most affected teeth [Adeniyi et al., 2012; Scavo et al., 2011; Demirci et al., 2010]. Caries prevalence is, however, unequally distributed worldwide. Indeed since 1970, in highly industrialised countries caries has shown a decreasing trend [Marthaler, 2004; Marthaler et al., 1996; Petersson and Bratthall, 1996], while in the more economically disadvantaged countries the disease has maintained high prevalence levels [Moynihan and Petersen, 2004; Marthaler, 2004]. Also in Western Europe, immigrants from developing countries still show a high caries incidence [Marthaler, 2004].

Within the countries where the prevalence of caries has decreased, this decline seems to be related to certain positive oral health-behaviours, particularly those performed daily at home, such as toothbrushing [Wiegand and Schlueter, 2014], use of fluoride toothpaste [Walsh et al., 2010; Twetman, 2009] and flossing in adults [Poklepovic et al., 2013]. The use of fluoride toothpaste favours enamel maturation, making the tooth more resistant to acid demineralisation, a condition caused by the lactic acid produced by microorganisms [Lynch, 2013]. Fluoride administration can also be performed in office by means of fluoride varnish applied to the molar surfaces. Different studies highlighted that fluoride varnish supplementation is useful in reducing caries prevalence by 18% to 59% [Chou et al., 2013].

Pit and fissure sealing of permanent molars is the most effective and worldwide employed preventive intervention to reduce caries incidence among the children population. The sealant applied on the permanent molar surfaces (rarely on other teeth) prevents residual food penetration and stagnation in pits and fissures [Courson et al., 2011; Topaloglu and Riza, 2010]. The use of sealants is particularly effective for high-caries-risk children, reducing the disease prevalence by 70% to 18.2%. Also, among low-caries-risk children, preventive sealant

resulted in an effective reduction of caries prevalence by 40% to 6.25% [Ahovuo-Saloranta et al., 20013]. Sealant application in the initial stages of first permanent molar eruption improves its prophylactic effectiveness, being this age period characterised by high childhood caries incidence [Mejare et al., 2014]. The children oral health status is in contrast with the caries “decreasing” trend found in adults living in industrialised countries [Dye et al., 2007; Haugejorden and Magne Birkeland, 2006; Whelton, 2004].

When dealing with pit and fissure sealing of molars, many of the most important studies in the literature, as well as the Italian Ministry of Health Guidelines, describe the practice as localised only in pit and fissure of the occlusal surfaces without any involvement of extra-occlusal (linguo-buccal) surfaces. This fact could be either linked to narrative synthesis needs or to the idea of low caries susceptibility of extra-occlusal surfaces. In order to clarify this aspect, an aepidemiological study was carried out choosing first lower permanent molars (FLPMs) as a privileged investigation site, being the molar the tooth which is more affected by caries [Adeniyi et al., 2012; Scavo et al., 2011].

Methods

Study questions

The following two questions were formulated as the basis of this study:

1. What is the absolute frequency (number) of occlusal and buccal caries affecting FLPMs in the considered population of children?
2. Can the independent variables of age, gender and parents' nationality be considered as potential risk factors for FLPMs buccal caries to such an extent as to suggest to seal the pits and fissures of these extra-occlusal surfaces as well?

Study population

This observational study involved a children population consecutively presented at the Paediatric Dentistry Department of the University of Perugia between February 2011 and December 2012 through the Unified Regional Booking Center (CUP) to undergo dental examination.

Inclusion criteria: children aged ≤ 14 years who attended the COU only through CUP booking and with at least one FLPM presenting the clinical crown well erupted from the gum were included in the study.

Exclusion criteria: children affected by organic or psychiatric syndromes, systemic diseases, severe intellectual or behavioural deficits were excluded from the study. Moreover, children unaccompanied by their parents during dental examination were also excluded. FLMPs affected by destructive caries or covered by full crown restoration or by orthodontic bands preventing a distinction between the buccal and occlusal caries were

not considered in this study.

Data recording and extraction

Two experienced paediatric dentists carried out the oral examination of the entire sample. The affected teeth and the caries distribution pattern among dental surfaces, such as occlusal, buccal, lingual and interproximal caries, were recorded. Dental health evaluations were performed according to the International Caries Detection and Assessment System (ICDAS) criteria, employing a flat-surface mouth mirror, a dental explorer, compressed air and lamp light. Radiographs were not used. Before the clinical examination informed consent was obtained from all parents to use the children's personal data for therapeutic and research scopes.

Two other experienced paediatric dentists examined all the clinical charts and extracted, independently, the data of interest. Disagreements were resolved by discussion.

Data analyses

Interest data calculated and index used:

- a) Prevalence of children with decayed FLPMs (number of cases/total included population);
- b) Absolute frequency (number) of FLPMs occlusal and buccal caries as well as their ratio and the absolute and percentage difference;
- c) Odds ratio (performing a multivariate logistic regression analysis) which relates FLPMs' buccal caries to variation of sex, age and parents' nationality. These variables were structured with dichotomous variation: age < 9 or ≥ 9 , male or female and both parents of Italian nationality or at least one Italian parent. Confidence intervals were calculated for each odds ratio measure. $P < 0.05$ was considered statistically significant.

Ethical considerations

The design of the study was approved by the Ethical Committee of the Umbria Region (CEAS Umbria), Italy.

Results

Of the 779 patients examined, about half of the sample ($n=304$) did not meet the inclusion criteria and were therefore excluded from the study. The most frequent exclusion cause ($n= 291$) was uncompleted FLPM eruption. An additional children sample ($n=15$) was not included because of unclear data recording in the clinical charts. The study, therefore, involved 460 subjects (243 males, 217 females) ranging between 5 to 14 years of age [mean age 8.61 (SD 3.1)], and almost two-thirds ($n= 335$) of the included children had both Italian parents.

Of the 460 children included, 393 (85%) resulted had no FLPM caries, whilst 67 showed caries in at least one of the FLPM (Table 1). The analysed FLPMs ($n=103$) showed an absolute frequency of 115 decayed tooth surfaces of which 62 (53.9%) affecting the occlusal surfaces and 53

| Children samples | Number | Percentage |
|----------------------------------|--------|------------|
| Total included subjects | 460 | 100% |
| Boys | 243 | 53% |
| Girls | 217 | 47% |
| With both Italian parents | 335 | 73% |
| With at least one foreign parent | 125 | 27% |
| Aged 5-9 years | 327 | 71% |
| Aged 10-14 years | 133 | 29% |

TABLE 1 Distribution pattern of total included children population within its subgroups.

| Interest data | Absolute frequency (n) | Frequency ratio | Percentage Difference (%) |
|---|------------------------|-----------------|---------------------------|
| FLPMs analysed | 105 | -- | -- |
| FLPM occlusal decayed surfaces | 62 | -- | -- |
| FLPM buccal decayed surfaces | 53 | -- | -- |
| FLPM occlusal and buccal decayed surfaces | 115 | 1.17 | 7.8 |

TABLE 2 Aepidemiological data of the occlusal and buccal caries affecting the lower first permanent molars (FLPMs).

| Children independent variables | Variable variation | Odds Ratio | 95% Confidence Interval | P-value | FLPM buccal caries |
|--------------------------------|---|------------|-------------------------|----------|-------------------------------|
| Sex | Female vs. Male | 2.66 | 1.27-5.58 | p=0.0096 | Statistically significant |
| Age (range) | 10-14 yrs vs. 5-9 yrs | 2.73 | 1.36-5.50 | p=0.0040 | statistically significant |
| Parents' nationality | At least one foreign parent vs. Italian parents | 1.47 | 0.71-3.06 | p= 09040 | not statistically significant |

TABLE 3 Associations between independent variables such as sex, age and parents' nationality and FLPM buccal caries.

the buccal surfaces with a ratio of 1.17 and an absolute difference of 9 (7.8%) surfaces (Table 2).

Within the subgroup of male patients (n=243), only 27 (11.1%) showed FLPM caries, while in the female subgroup (n=217), 40 (18.4%) showed FLMP caries. The female gender was significantly associated with buccal caries on the FLPM [Odds Ratio = 2.66 (95% CI, 1.27-5.59, p=0.0096)].

Among the children aged 5-9 years (n=327), 35 (10.7%) showed FLPM caries. Of the children aged 10-14 years (n=133), 32 (24.1%) showed FLMP caries. The 10-14 years age range group as well as the female gender were significantly related to buccal caries of FLPM [Odds Ratio = 2.73 (95% CI; 1.36 - 5.50; p=0.004)].

Of the children with both Italian parents (n=336), 46 (13.7%) had FLPM caries, while among the children with one foreign parent (n=125), 22 exhibited FLPM caries (17.6%). Although the children with at least one foreign parent showed more decayed buccal FLPM surfaces than those with both Italian parents, the nationality variable was not statistically associated with the caries [Odds Ratio= 1.47 (95% CI; 0.71 - 3.06; p= 0.9040)] (Table 3).

Discussion

In this study both the FLPM occlusal and buccal caries affecting the children population aged 5-14 years attending the COU of Perugia showed comparable absolute frequency values (n= 62 vs. 53). Indeed, the percentage difference between this two types of caries

resulted comparable, lower than 10%. For this reason the preventive interventions deemed effective in reducing the caries prevalence on the occlusal surfaces should be considered also useful for the buccal surfaces, due to their similar caries susceptibility. The unmentioned extension of the pit and fissure sealing on the extra-occlusal molar surfaces in several consulted studies, therefore, should not be linked to cariology considerations, but rather to expositive synthesis needs. In order to give a conclusive answer, further randomised controlled clinical trials should be carried out to compare the potential effectiveness difference between occlusal surfaces alone versus occlusal plus extra-occlusal pit and fissure sealing in reducing FLPM caries.

In this study the female gender resulted as a risk factor for FLPM buccal caries. This condition seems in disagreement with the data emerging from a recent review conducted on this topic in which a lack of evidence was found concerning sex difference in caries prevalence [Martinez-Mier and Zandona, 2013]. A possible explanation for the different gender-related caries susceptibility could be linked to the greater "dental fear" shown by the female population of the study compared to the male population [Carrillo-Diaz et al., 2013]. The gender dependency of dental fear with a higher level of anxiety in girls has already been reported in other studies [Östberg and Abrahamsson, 2013; Stenebrand et al., 2013; Peretz and Kharouba, 2013; Van Meurs, 2005].

In this aepidemiological study, an older age was also found to be a potential predisposing factor for FLPM buccal caries in the childhood population. This observation

meets those reported in other similar studies according to which the caries permanent teeth prevalence or caries index (DMFT or SiC values) increased with age among children [Darmawikarta et al., 2014; Dawkinns et al., 2013; Eslamipour et al., 2010] and adolescents [Markovic et al., 2014; Arnadóttir et al., 2010; Bastos et al., 2010]. In order to reduce the number of decayed surfaces, pits and fissures could be therefore sealed during their first eruption steps before the period of highest caries incidence.

Although in this study the caries prevalence recorded among children with at least one foreign parent was greater than that for children with both Italian parents, it did not reach a statistically significant difference. Parents' nationality cannot therefore be considered a potential risk factor for FLPM caries. These data were in partial agreement with the results reported in several other studies which expressed a strong relationship between the parents' provenience (particularly the mother's nationality) and their children's caries prevalence [Relvas 2014; Wändell 2013; Edelstein 2002].

Of the previous reported studies relating the caries frequency to age, sex and parents' nationality, none were found focusing specifically on FLPM buccal caries, and therefore their critical relationship with the present study should be deemed as both incomplete and imprecise.

Conclusions

The usefulness of pit and fissure sealing extension on the buccal surfaces in addition to the occlusal prophylactic intervention on the FLPMs should be considered and tested with further comparative effectiveness studies, particularly with regard to the female sex and during the early eruption steps of these teeth.

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