Atraumatic Restorative Treatment used for caries control at public schools in Piracicaba, SP, Brazil

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Abstract

Aim: The aims of this study were (1) to evaluate the Atraumatic Restorative Treatment (ART) as a measure to control caries at public schools in Piracicaba, SP, Brazil, discussing the importance of the promotion of individual and collective health and (2) to evaluate the longevity of ART restorations in the first six months after placement. Methods: The sample consisted of 173 schoolchildren aged 5 to 10 years from public schools in Piracicaba, treated according to ART approach and reassessed after six months. Results: It could be observed that after ART, a large part of the students initially fitted into risk E classification (high caries risk) were reclassified into risk B classification (moderate caries), characterized by the presence of restored teeth only (caries free teeth; c = 0). In addition, 81.78% success rate was obtained after six months of ART. Conclusions: ART was considered effective in health promotion programs, given its importance as a measure to control caries in schoolchildren.

Keywords: dental atraumatic restorative treatment, dental caries, public health.

Introduction

Although dental caries prevalence has declined significantly over the last few years, it is still considered a public health problem in Brazil and worldwide. This fact is confirmed when the data of the last national epidemiologic survey are analyzed, indicating that among 5-year-old children approximately 60% presented at least one primary tooth with caries experience, and 70% of the 12-year-olds presented caries in their permanent dentition¹.

In view of this situation, dental control and follow-up are necessary during childhood and adolescence for preventing or attenuating the affections caused by caries disease. With the goal of encouraging health promotion measures required for caries control and prevention, the World Health Organization (WHO) proposed the program of Atraumatic Restorative Treatment (ART) for countries with economically underprivileged or marginalized communities². ART has been considered a feasible treatment option, as it is based on the contemporary philosophy of minimum intervention and maximum preservation of the tooth,
and can be applied to the entire population. ART consists of a simplified, low-cost technique that uses only hand instruments in the removal of carious tissues to reduce contamination and viability of microorganisms, and requires immediate restoration of the cavity with adhesive restorative material, namely glass ionomer. Moreover, the ART approach causes less anxiety in children than the traditional restorative approach.

It is worth mentioning that the use of high-viscosity glass ionomer cements has been outstanding, as it facilitates the technique and reduces the technical difficulties, especially in public services. In this context, studies have pointed out the clinical performance of the glass ionomer cement Ketac Molar® (3M ESPE). Other studies have found better results for glass ionomer over conventional amalgam in restorations in primary and permanent teeth, favoring with water supply. The Human Development Index (HDI) of the municipality was 0.836 in 2000, according to which the sample. A trained dentist performed ART in accordance with the criteria described by Frencken et al. (1996), with a dmft index of 1.30 in 2006 and 1.32 in 2010.

Before treatment, an epidemiologic survey of dental caries was conducted to obtain the children’s dmft and caries risk classification, as well as to verify the caries cavities with indication for ART. The dmft index was determined in accordance with the WHO criteria and the caries risk evaluation was obtained in accordance with the criteria of the State Secretariat of Health, according to which the schoolchildren were classified into five different categories: A (healthy teeth), B (presence of restoration), C (presence of chronic caries), D (presence of plaque, gingivitis or white spot lesion), E (presence of acute caries) and F (urgency) (Table 1).

The criterion used for the indication of ART followed the criteria described by Frencken et al. (1996), with evaluation of primary teeth only. Thus, teeth with cavited dentin caries lesion that could be accessed with a 0.9-mm-diameter excavator were included. Teeth with evident pulp involvement or painful symptotology were excluded from the sample. A trained dentist performed ART in accordance with the protocol proposed by Frencken et al. (1996). The treated caries cavities were restored with glass ionomer Ketac Molar® (3M ESPE), in accordance with the manufacturer’s instructions.

The longevity of ART restorations at 6 months was

Material and methods

The present study was first sent to the Research Ethics Committee of the Piracicaba School of Dentistry (University of Campinas) for approval, and was approved under Protocol No. 106/2009. The children’s and parents’/guardians’ consent was obtained.

The convenience sample analyzed 1,167 children in the age range between 5 and 10 years old. A total of 173 schoolchildren with indication for ART were included, totaling 330 teeth. The children came from six public schools (Olivia Caprânico, José Pousa de Toledo, Benedito de Andrade, Francisco A. Kronka, Antônio Rodrigues Domingues and Melita L. Brasiliense) in the municipality of Piracicaba, São Paulo, which participate in prevention programs.

The Municipality of Piracicaba is located 160 km from São Paulo, in the southwestern region of the state, and has 368,029 inhabitants. It has had fluoridated public water supplies since 1971 and at present 99.38% of residents are favored with water supply. The Human Development Index (HDI) of the municipality was 0.836 in 2000, according to which the schoolchildren were classified into five different categories: A (healthy teeth), B (presence of restoration), C (presence of chronic caries), D (presence of plaque, gingivitis or white spot lesion), E (presence of acute caries) and F (urgency) (Table 1).

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The longevity of ART restorations at 6 months was
evaluated according to the criteria proposed by Taifour et al. (2002), with the use of a flat oral mirror and CPI probe by a single calibrated examiner, with intra-examiner agreement of 84.2%. The criteria used for evaluating the restorations were described and grouped into 3 categories: a) success (restorations present with a maximum of 0.5 mm marginal defect); b) failure (restorations with a marginal defect >0.5mm, fracture of the restoration or tooth, restoration completely lost); and c) not evaluated (absent due to natural exfoliation of the tooth or replacement of the glass ionomer restoration by another type of restorative material) or excluded (children who missed the evaluation visit, moved to another school or completed primary schooling in the period between baseline and reevaluation).

The data were tabulated and analyzed by descriptive statistics, using the SPSS software (SPSS Inc., Chicago, IL, USA) version 17.0.

### Results

It could be observed that among the 173 schoolchildren subjected to ART, 81 (46.82%) were boys and 92 (53.18%) were girls. The mean age was 7.36 years (SD 1.36), ranging between 5 and 10 years. The descriptive data are presented in Table 2.

At the time of the epidemiologic survey (baseline) the children selected for treatment according to ART presented a dmft equal to 3.38, with mean number of decayed teeth equal to 2.55. After treatment, the children were re-evaluated and presented a mean of the ‘decayed’ component of dmft equal to 0.72.

In addition, in the previous survey, the schoolchildren were classified with regard to the criterion of risk and reclassified after ART had been performed. In the first evaluation, all participants fitted into the risk E classification, due to the presence of carious teeth. After ART, a large part of the schoolchildren were re-classified into risk B, characterized by the presence of restored teeth only (no caries lesions). Nevertheless, it is worth pointing out that even with the reclassification, 53.1% of the schoolchildren presented teeth without indication for ART, but with the need for curative and/or preventive treatment. Thus, 20.2% of the participants still presented white spot lesions, plaque or gingivitis in some teeth, fitting into risk D classification. The remainder of the schoolchildren (32.9%) still presented carious teeth with contra-indication for ART, keeping them in risk E (presence of acute cries), as demonstrated by the distribution in Table 3.

Six months after the initial treatment, a new evaluation/follow-up was performed (Table 4). Thus, 36 (10.9%) of the

### Table 1. Table used as a reference for the classification of individuals according to the risk of caries.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Group</th>
<th>Individual Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk</td>
<td>A</td>
<td>Absence of caries, plaque, gingivitis and/or white spot</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>History of restored teeth, without plaque, gingivitis, and/or white spot</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>One or more cavities in a situation of chronic caries, lesions, but no plaque, no gingivitis, and/or white spot</td>
</tr>
<tr>
<td>High Risk</td>
<td>D</td>
<td>Absence of caries and/or restored teeth, but with presence of plaque, gingivitis and/or white spot</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>One or more cavities in a situation of caries</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Presence of pain or abscess</td>
</tr>
</tbody>
</table>

Health Department of São Paulo State, (2000)

### Table 2. Distribution of children by age, gender, mean dmft and “decayed” component in the173 schoolchildren participating in the study.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Gender</th>
<th>Total</th>
<th>dmft (mean)</th>
<th>Decayed component “d” (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>23</td>
<td>20</td>
<td>43</td>
<td>4.05</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
<td>24</td>
<td>42</td>
<td>3.31</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
<td>21</td>
<td>37</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>16</td>
<td>16</td>
<td>32</td>
<td>3.34</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>3.60</td>
</tr>
<tr>
<td>Total</td>
<td>81</td>
<td>92</td>
<td>173</td>
<td>3.38</td>
</tr>
</tbody>
</table>

### Table 3. Distribution of the risk evaluation among schoolchildren before and after ART

<table>
<thead>
<tr>
<th>Risk</th>
<th>Classification before ART</th>
<th>Classification after ART</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>A</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>173</td>
<td>100</td>
</tr>
<tr>
<td>F</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>173</td>
<td>100</td>
</tr>
</tbody>
</table>
teeth re-evaluated presented another type of restorative material, or had exfoliated naturally, and 25 teeth (7.6%) were not evaluated because the children had moved to another school, making longitudinal evaluation of the restoration impossible. Therefore, 269 (81.51%) of the 330 teeth initially treated were re-evaluated 6 months after treatment with a success rate of 81.78%.

**Discussion**

From the 173 schoolchildren subjected to ART, 67% shifted from caries risk classification E (acute caries) to risk classification B (restoration) or D (white spot lesion, plaque and/or gingivitis). These data demonstrate that ART per se improved the oral status of a large percentage of the children treated, as described by Frencken et al.\(^3\) (2010). Nevertheless, among the schoolchildren that shifted from risk E to risk D (20.2%), implementation of educational measures allied with motivation to perform oral hygiene is still necessary to decrease the prevalence of biofilm, white spot lesions and gingivitis. Thus, the children fitted into risk D could, by means of simpler actions than ART, shift into risk B with improved oral health, and consequently, quality of life. Therefore, ART must be considered a measure for promoting public health and should be performed in conjunction with practices in health education and preventive programs to be effective in controlling the etiologic factors of caries\(^26\)-\(^27\).

Furthermore, in spite of ART, 32.95% of the schoolchildren remained in the risk E classification, that is, continued to have caries, which could be justified by two situations: 1) teeth with cavities with pulp involvement or painful symptomatology (contraindicated for ART); 2) presence of carious permanent teeth, not included in the indications for ART in this study. In spite of the mentioned factors, an improvement in the schoolchildren’s oral health was observed by the reduction in the mean of the ‘decayed’ component of dmft from 2.55 to 0.72, proving the effectiveness of this type of treatment.

ART improves the oral status, preventing caries progression to more complex levels, such as the need for endodontic treatment and extractions. This occurs because ART fits into the concept based on the prevention and early interception of the caries process, with the goal of performing interventions that are as conservative as possible\(^2\),\(^11\),\(^28\). In addition, the treatment allows a reduction in the level of *Streptococcus mutans* in the oral cavity, and consequently, the risk of new carious lesions\(^1\).

Considering the large number of children that wait for treatment at the Family Health Units or Basic Health Units, ART can collaborate significantly in fulfilling the demand of these pediatric patients, being an important form of caries control and prevention in the Family Health Program\(^5\),\(^29\)-\(^30\).

It is also worth emphasizing that as a low-cost, simple and fast (mean of 6 min per restoration) technique ART may optimize the time and human resources that would be required, for example, to transport these children to a location outside the school environment during treatment, as has been described by Figueiredo et al.\(^39\) (2004); Schriks and Amerongen\(^17\) (2003) and Pellegrinetti et al.\(^18\) (2005). However, a limiting factor as far as minimal dental intervention is concerned, is the overall difficulty of acceptance by dentists. Rios et al.\(^31\) (2006) evaluated professionals from the public service in Goiânia and found that less than half of the professionals (42.8%) believed in the efficacy of the technique, and that more information would be required about the technique, its efficiency and its use in public service.

In spite of the difficulties encountered, mainly in following up the restorations, ART continues to provide an important scope for covering schoolchildren as well as the community in general, taking into account the shorter time for performing restorations and its low cost\(^2\). In this context, Mickenautsch et al.\(^32\) (2002) reported that the introduction of ART into a mobile dental assistance program led to a significant reduction in the percentages of amalgam restorations and extractions.

According to the results of the present study, ART appeared as a feasible alternative for caries treatment, particularly in collective health, with proven efficacy, low cost and broad improvement in covering dental care to schoolchildren. These factors may be observed by the technique simplicity and speed of the procedures and contribution to the problem of the huge repressed demand by patients with treatment needs. It could therefore be concluded from this six-month evaluation that ART was effective within health promotion programs as an important measure to control caries disease in schoolchildren.

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**References**


