

Longevity of atraumatic restorations performed by undergraduate dentistry students

Longevidade de Restaurações Atraumáticas realizadas por graduandos de Odontologia

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Resumo

Introdução: O Tratamento Restaurador Atraumático (ART) possibilita o tratamento de cárie com o auxílio de instrumentos manuais e sem anestesia, em locais onde o acesso a consultórios é impossibilitado, e é considerada uma técnica de fácil execução. **Objetivo:** Avaliar a efetividade do ART realizado pelos estudantes de graduação de odontologia em escolares de 4 a 11 anos de idade de Piracicaba-SP nos anos de 2009 e 2010, na dentição decídua, e a longevidade das restaurações em 6 e 12 meses. **Método:** A análise dos dados foi descritiva, e para avaliar diferença entre os grupos foi utilizado teste qui-quadrado (intervalo de confiança de 95%). **Resultado:** O sucesso das restaurações atraumáticas realizadas foi de 51,90% aos 6 meses e 47% aos 12 meses. A efetividade do ART variou segundo o tipo de restauração aos seis meses e aos 12 meses de reavaliação, apresentando maior sucesso em restaurações Classe I do que em restaurações Classe II ($p < 0,001$). **Conclusão:** O sucesso do ART realizado por alunos de graduação foi próximo de 50% aos 6 e 12 meses, sendo significativamente melhor em cavidades Classe I nas duas avaliações.

Descritores: Cárie dentária; saúde pública; cimentos de ionômeros de vidro.

Abstract

Introduction: Atraumatic restorative treatment (ART) is a simple technique that enables the treatment of caries with hand tools and without anesthesia where clinic access is lacking. **Objective:** To evaluate the effectiveness of ART conducted in the primary dentition of 4-11-year-olds in 2009 and 2010 by graduate dental students in Piracicaba, SP, and the longevity of restorations at 6 and 12 months. **Method:** Descriptive data analysis was performed. Differences between groups were assessed using the chi-squared test with a 95% confidence interval. **Result:** The success rates of ART were 51.90% at 6 months and 47% at 12 months. Class I ARTs were more successful than class II ARTs at 6 and 12 months ($p < 0.001$). **Conclusion:** Approximately 50% of ART performed by undergraduates students have succeeded and was significantly better for class I carious lesions at both evaluation time points.

Descriptors: Dental caries; public health; glass ionomer cement.

INTRODUCTION

The World Health Organization (WHO) has recommended the application of atraumatic restorative treatment (ART) when the lack of dental offices prevents traditional restoration^{1,2}. ART is indicated for adults and children, in deciduous and permanent teeth, independent of socioeconomic conditions, and should not be considered a procedure of oral diseases, since restoring produced can be considered definitive³.

The technique is well accepted for fearful patients because it eliminates the use of anesthesia^{4,5}. It can be applied in rural or suburban areas and disadvantaged communities (including those in which minority groups live), and can be used to treat patients in nursing homes, day care centers, and orphanages¹. It also enables care provision to groups resistant to conventional

treatment and provides access to regular care for people who lack basic dental care services.

ART was developed in the 1980s as a method of preserving decayed teeth in individuals of all ages in developing countries and underserved communities, with a strong focus on reducing oral contamination¹. It is thus considered to be a technique for the treatment of carious lesions in public health contexts⁶. Hand tools are used to partially remove dentin affected by caries, followed by the sealing of the cavity with glass ionomer cement⁵. The irreversibly infected dentin, highly contaminated by cariogenic microorganisms and responsible for the progression of the carious lesion, is removed only with curettes, preserving the deeper portion and allowing for dentin remineralization^{5,7}. ART

is thus minimally invasive and reduces the likelihood of the need for future endodontic treatment and extraction. It is also very practical because it does not require the use of traditional dental equipment, local anesthesia, or electricity, and is considered to be more comfortable for the patient than traditional restoration⁸.

To promote the application of ART, the Piracicaba Dental School (FOP) of the University of Campinas (UNICAMP), Brazil, was incorporated in 2009 to the extramural stage, the final year of graduation. Students perform ART in 4-11-year-olds in school environments. In addition to providing technical introduction to graduate students, this service meets a demand of the population that is not otherwise addressed.

Despite the ease of implementation⁵, the longevity of restorations performed using this minimally invasive technique must be evaluated to verify its success. Reported success rates of atraumatic class I and class II restorations in primary teeth range from 43.4% to 96.7% and from 12.2% to 83.3%, respectively³. A study in which permanent molars were evaluated 10 years after ART demonstrated the validity and potential of this approach for the restoration and preservation of posterior permanent teeth⁹.

The aim of this prospective study was to evaluate the effectiveness of ART in deciduous teeth conducted by undergraduate FOP students in 2009 and 2010, and the longevity of restorations at 6 and 12 months.

METHOD

This study was conducted in accordance with the rules and ethical guidelines of Resolution No. 196/1996 of the National Board of Health, Ministry of Health, and approved by the local research ethics committee (protocol no. 77/2010). Caretakers of all participants provided written informed consent to their children's inclusion in the study.

FOP-UNICAMP implemented the National Program for the Reorientation of Vocational Training in Health (ProHealth) in 2008, and six family health units (FHU) were selected as partners for the development of extramural activities. Eighty college graduates conducted activities aiming to integrate academic knowledge with routine public health care work in the FHUs for 1 week per semester. Students performed ART under the direct supervision of professional dentists at schools and kindergartens in rooms made available for that purpose. The primary purpose of this activity was to present the ART technique within the setting of a broader educational program in which the schools and kindergartens were already participating.

Before ART was performed, 10 dental college graduates trained by an experienced epidemiologist (MLRS) conducted epidemiological surveys of caries (LECs) in early 2009 in 10 bound FHUs at six public schools to evaluate the indication for ART in the primary teeth of students aged 4-11 years. Students attended lectures and participated in practical exercises (12 h total) in preparation for the LECs. The surveys were conducted using WHO-recommended criteria and indices. A total of 3731/4465 eligible children (83.6% response rate) were examined. The

percentage of intra-examiner agreement was 84.20% [$\kappa = 0.84$ (confidence interval, 0.80-0.89)].

ART was performed in deciduous teeth according to the standard evidence-based protocol¹⁰. Infected dentin softened and consistency was irreversibly removed using hand tools under relative isolation without local anesthesia. Each cavity was then sealed with glass ionomer cement (Ketac Molar).

Calibrated graduate students assessed the effectiveness and longevity of atraumatic restorations at 6 and 12 months post-treatment (between August 2009 and December 2010) using a mirror and a WHO-621 explorer with a 0.5-mm ball at its tip, which allows the measurement of restoration maladaptation. The clinical evaluation followed criteria adapted from Taifour et al.¹¹, as follows: 0 = satisfactory ART, 1 = margin of 0.5 mm, 2 = partial loss of restorative material, 3 = total loss of restorative material, and X = missing or exfoliated tooth. In the present study, a score of 0 was considered to indicate successful ART and a score of 1-3 was considered to indicate treatment failure.

Descriptive data analysis was performed using Excel[®] and BioStat 5.3 software. The Chi-square test was used to assess differences between groups, with a 95% confidence interval.

RESULT

The dental school graduates performed a total of 514 restorations using the ART technique. Of these, 315 (61.28%) teeth were assessed at least once. A total of 43 teeth were exfoliated between the ART procedure and evaluations (21 teeth before 6 months and 22 teeth before 12 months). Table 1 shows the numbers of teeth treated and evaluated, and ART success rates at 6 and 12 months.

Table 2 shows the success of atraumatic class I and class II restorations at 6 and 12 months. The success rate differed according to restoration class, being significantly better for class I in both evaluations (6 and 12 months).

DISCUSSION

About half of ARTs performed by dental school graduates remained in the oral cavity at the 12-month assessment. This success rate falls within the large range (30-98%) of previously reported rates¹¹. Given that these ARTs represent the students' initial experience with the technique, and that the success rate is similar to those reported for some experienced professionals at 12 months⁹, we consider this degree of success to be appropriate.

Regardless of treatment success, ART involves the removal of irreversibly infected and decayed tissue, promoting decontamination. The exposure of affected dentin to glass ionomer, a restorative material used in ART that bonding and releases fluoride, positively interferes with caries activity¹². The retention of these restorations for even a brief period of time allows the remineralization of affected dentin, increasing hardness and reducing susceptibility to demineralization¹². ART thus improves oral health, even when the restorative material is lost. For this reason, we have promoted the participation of schools and day

Table 1. ART implementation and evaluation at 6 and 12 months seconds family health units, 2009-2010, Piracicaba, SP, Brazil

Family health unit	ART performed (total)	ART evaluated (total)	ART evaluated at 6 months	Success at six months n (%)	ART evaluated at 12 months	Success at 12 months n (%)
A	143	100	100	40 (40.00)	0	-
B	83	52	15	8 (53.33)	40	14 (35.00)
C	84	32	26	13 (50.00)	0	-
D	94	68	59	41 (69.49)	44	23 (52.27)
E	52	34	33	25 (75.75)	17	11 (64.70)
F	58	29	29	11 (37.93)	16	7 (43.75)
Total	514	315	262	138 (52.67)	117	55 (47.00)

ART, atraumatic restorative treatment. Source: Extramural Internship. Faculty of Dentistry of Piracicaba-UNICAMP (2009-2010).

Table 2. Success and failure of class I and class II ARTs at 6 and 12 months in Piracicaba, SP, Brazil[†]

Evaluation	Total ART	Class I ART		Class II ART		p	OR	95% CI		
	n	n	Success n (%)	Failure n (%)	n				Success n (%)	Failure n (%)
6 months	241	77	51 (66.23)	26 (33.76)	164	85 (51.82)	79 (48.17)	<0.0001	1.81	1.17-1.79
12 months	93	21	15 (71.42)	6 (28.57)	72	39 (54.16)	33 (45.83)	<0.0001	2.40	1.10-5.73

ART, atraumatic restorative treatment; OR, odds ratio; CI, confidence interval. [†]Exfoliated teeth were excluded from analyses. Source: Extramural Internship. Faculty of Dentistry of Piracicaba-UNICAMP (2009-2010).

care centers in the ART intervention of the FOP-UNICAMP educational program, in association with ProHealth.

ART is indicated primarily for small carious lesions involving a single face, due to the biomechanical properties of the restorative material¹³. In the present study, the type of restoration was dichotomized as class I or II. The 6-month success rate was higher in restorations involving only one face than in those involving multiple faces. These results corroborate those of Franca et al.³, who noted greater success of class I than class II restorations at 6 months.

The number of teeth in which ART was classified as failed at 12 months may have been underestimated. Because ART evaluation was performed as an internal control of the students' performance, restorations considered to be unsuccessful at 6 months were not reassessed at 12 months, and thus were not included in the analysis of 12-month data.

Given the longitudinal nature of this study, only 262 (50.98%) and 115 (22.37%) restorations were evaluated at 6 and 12 months, respectively. This sample loss was due mainly to students' absence at the time of assessment, due to a change of school or for other reasons.

Dentists continue to resist the use of ART, which generally involves the use of glass ionomer cement to provisionally restore buccal lesions¹¹. Thus, the importance of extramural activities in dental education should be emphasized. Such activities introduce dental students to public health contexts and provide experience

with the Unified Health System, offering a different perspective on the practical applications of ART. The ART intervention is one of several activities included in FOP-UNICAMP's ProHealth program, and it addresses an otherwise unmet dental health need of schoolchildren, thereby directly benefitting the community. Thus, in addition to being introduced to the technique in a public health context, graduate students observed the practicality of ART application and the high impact of this treatment in the population served. They observed the acceptance of this technique in a school or family health environment and the ability to avoid pain and rotary instrument use, which can cause aversion to dental care in schoolchildren. After the activity, graduate students discussed with participating dental students the relevance and implications of the technique in public health, and the impact on the community in terms of reduced caries risk⁶.

This study allowed us to observe the effectiveness of ART performed by graduate students in a real-world context. Whereas the main objective of the activity was to introduce the ART technique to graduating students, evaluation of the longevity of restorations performed during their initial experience allowed us to assess the role of professional experience in the success of restoration. The students' inexperience may have negatively influenced the results, especially with regard to sample loss throughout the follow-up period, which may stand in contrast to evaluation by a professional in the Family Health Strategy.

In conclusion, approximately 50% of ART was succeeded, and the longevity performed by dental school graduates was

significantly superior in class I (one involved tooth surface) than in class II (multiple involved surfaces) carious lesions. Beyond providing experience and the opportunity to acquire expertise to undergraduate students participating in ProHealth, the inclusion of the ART intervention in dental education could contribute effectively to the otherwise unmet demands for dental care and treatment in schoolchildren in Piracicaba, SP, Brazil.

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CONFLICTS OF INTERESTS

The authors declare no conflict of interest.

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