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SURVIVAL OF FUJI IX ART FILLINGS IN PERMANENT TEETH OF PRIMARY SCHOOL CHILDREN IN TANZANIA

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SURVIVAL OF FUJI IX ART FILLINGS IN PERMANENT TEETH OF PRIMARY SCHOOL CHILDREN IN TANZANIA

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ABSTRACT

Objective: To evaluate the clinical performance of atraumatic restorative treatment (ART) fillings using Fuji IX as a filling material in field conditions.

Design: Longitudinal study of the ART fillings in permanent teeth of primary school children aged eight to fifteen years.

Setting: Primary schools in Morogoro municipality, Tanzania.

Subjects and methods: Standard 3 and 4 children in five primary schools randomly selected from a list of 36 primary schools of Morogoro municipality were examined for dental caries and periodontal conditions. All 296 carious lesions that were indicated for restoration were treated using ART approach according to the instructions given in the manual for ART approach for the control of dental caries. Essential measurements for treated teeth and cavity were taken. The cavities were filled with Fuji IX glass ionomer cement as per manufacturer's instructions. After one year, 238 restorations were evaluated using the criteria for evaluating ART restorations.

Main outcome measure: Clinical appearance of the surface of the restorations.

Results: Ninety four per cent of the restorations evaluated were rated as good and intact, while 1.7% were rated as having slight defects that needed no repair, giving a one year survival rate of 96.1%. Mean working time was 14.5 minutes.

Conclusions and recommendations: The one-year survival rate of 96.1% is high enough to recommend wide use of ART in Tanzania. Town and municipal councils should be encouraged to adopt ART in their school oral health programmes.

INTRODUCTION

Fuji IX is an improved glass ionomer cement specially manufactured for filling cavities prepared with hand instruments in atraumatic restorative treatment (ART) for dental caries(1). It is claimed to have higher wear resistance and strength than previously used glass ionomer cements. ART has been developed to reduce the obstacles inherent in the conventional restorative technique. These obstacles include, noise, pain and unpleasant sensation resulting from rotating instruments, use of electricity, and expensive equipment that are used in conventional restorative technique. Due to these obstacles conventional restorative technique has been rendered inaccessible to the majority of people in developing countries, Tanzania included. Because of its potential benefits documented so far(2-4), manufacturing companies of dental materials are searching for better

filling materials that have adhesive properties and higher wear resistance, and different countries are undertaking community field trials for ART to test its appropriateness as a caries treatment modality.

The inaccessibility of the conventional restorative technique for dental caries to most Tanzanians is clearly reflected in the minimal contribution of F-component of the DMF-T index recorded in epidemiological studies on dental caries. In all the publications from Tanzania, the filling component of the DMF-T index is negligible(5-12). Adopting ART in Tanzania may improve the accessibility of restorative care and therefore oral health care in the country. In view of this expectation, ART community field trial was started in Morogoro, Tanzania in October 1998 to determine the survival of Fuji IX fillings in different cavity sizes prepared by hand instruments only. This study reports on the evaluation of these ART fillings after one year.

MATERIALS AND METHODS

Subjects, identification of carious lesions and placement of ART restorations: Five schools were randomly selected from a list of 36 primary schools in Morogoro municipality. School children in standard 3 and 4 who were attending these schools were examined for periodontal conditions and dental caries according to WHO criteria(13). The oral health status of these children is reported elsewhere(14). All carious lesions that were categorised as needing restorative care were treated using ART approach according to the instructions given in the manual for the Atraumatic Restorative Treatment (ART) approach to control dental caries(15). When all the carious tissue had been removed, and the gross undermined enamel chiselled off, mesio-distal, bucco-lingual or bucco-palatal width and depth of the cavity were measured using periodontal probes with 2 mm graduation intervals and recorded to the nearest highest reading; e.g. if the measurement was between 2mm and 4mm, then 4 mm was recorded. The cavities were then filled with GC Fuji IX glass ionomer cement as per manufacturer's instructions(1).

Evaluation: After 12 months, fillings were evaluated using the criteria provided by Frencken who has worked intensively with ART(2-4). This criteria has nine interval scales (Table 1): To facilitate evaluation process, children were requested a day before to brush their teeth thoroughly after breakfast before coming to school. Evaluation examinations were conducted in the mornings between 8.00 and 10.00 a.m. as soon as the children came to school. In addition, children were requested to rinse their mouth before they came to the examination site. In this way, food debris and plaque were reduced from the majority of tooth surfaces, making inspection of the fillings easier. WHO periodontal probes were used to measure the defects in a filling.

Analysis: Data were fed into a computer and analysed using EPI Info version 6.1 programme. The occlusal surface area of the treated tooth was determined by multiplying its mesio-distal length by bucco-lingual width. The surface area of the cavity was similarly obtained. Cavity depth multiplied by surface area of the cavity gave the volume of the filling. Ratios between the tooth surface area and of the cavity area were calculated. Frequencies were then generated to determine the distribution of variables measured. Relationship between survival score of the fillings and cavity depth, cavity area, cavity volume and area ratio was tested using chi-square test. Due to the low numbers of the fillings that had defects, low associations existed, therefore comparison of survival rates with cavity sizes are not reported in this paper.

RESULTS

There were 196 standard 3 and 4 children who had their decayed teeth treated by ART in October 1998. Their mean age was 10.8 years (SD=1.4), maximum age being 15 years and minimum eight years. The average depth of the cavities was 2.6 mm, and the mean working time for a restoration was 14.5 minutes. One hundred sixty one children were available for evaluation in October 1999.

Table 2 shows the distribution of restorations by jaw, tooth type and surface. Ninety seven per cent of all restorations were placed in molars. Restorations in lower molars accounted for 75.7% of all the restorations. Ninety two per cent of the restorations were on occlusal surfaces. Buccal and palatal pit restorations accounted for only 7.4%.

Table 1

Evaluation criteria for ART restorations	
Score	Criterion
0	Present, good
1	Present, slight marginal defect for whatever reason, at any one place which is less than 0.5 mm in depth. No repair is needed.
2	Present, wear and tear gradually over larger parts of the restoration but is less than 0.5 mm. at the deepest point. No repair is needed.
3	Present, marginal defect for whatever reason, at any one place which is deeper than 0.5 mm. Repair is needed.
4	Present, wear and tear gradually over larger parts of the restoration which is deeper than 0.5 mm. Repair is needed.
5	Not present, restoration has (almost) completely disappeared. Replacement is needed.
6	Not present, other restorative treatment has been performed.
7	Not present, tooth has been extracted.
9	Unable to diagnose

Note:: Restorations that have survived are scored by codes: 0,1,2; those that have failed are scored by codes: 3,4,5; those that are unrelated to survival and failure are codes: 6,7.

Table 2

Distribution of restorations by jaw, tooth type and surface

Tooth types	Lower jaw		Upper jaw		Total	
	No.	%	No.	%	No.	%
Molars	224	75.7	63	21.3	287	97.0
Premolars	2	0.7	6	2.0	8	2.7
Incisors	0	0.0	1	0.3	1	0.3
Total	226	76.4	70	23.6	296	100.0
Surface pattern					No.	%
Occlusal					273	92.2
Buccal/palatal pit					22	7.4
Mesial/distal					1	0.4
Total					296	100.0

Table 3

Condition of evaluated restorations according to survival score

Condition of restorations	No.	%
Present and good	225	94.5
Slight defects no need of repair	4	1.7
Overall success/survival	229	96.2
Defects needing repair	0	0.0
Not present, needing replacement	9	3.8
Total restorations evaluated in October 1999	238	100.0

The rate of drop out of the 296 fillings was 58 (19.6%) and altogether 238 fillings were evaluated. The distribution of evaluated restorations according to survival score is shown in Table 3. More than ninety four per cent of the evaluated restorations were rated as good, 1.7% were rated as slightly

defective with no need for repair, giving a survival rate of 96.2%. About four per cent of all the evaluated restorations were completely lost and were rated as needing replacement.

DISCUSSION

The rate of drop out in this study was quite high (19.6%), acceptable to a field study. This was due to absenteeism and migration to other schools and because 35 children were not at school during the time of evaluation. Finally 58 fillings could not be evaluated.

The restorations that met criteria for survival were 96.2%. This is in agreement with the one-year survival rates reported in other ART studies in Zimbabwe(2), China(16) and Tanzania(17), where 93.4%, 93% and 97.7% restorations were rated as needing no repair respectively. The survival rates were a bit higher than those reported in Cambodia(18), where one year survival rate was 76.3%, and in Brazil(19), where one year survival rates were 75.3% for Class I fillings in deciduous teeth. The failed restorations were completely missing. Although not reported in the tables, the nine fillings that were lost were of all cavity sizes. These failures were most probably due to defective procedures like saliva contamination during insertion of filling material into the cavity or prolonged manipulation that affected setting of glass ionomer cement. Close examination of the four fillings that had slight defect revealed that they were overfilled resulting in premature contact.

The mean working time of 14.5 minutes in this study was in between the mean working times reported in other field trials. Frencken *et al*(2) reported a mean working time of 22.1 minutes, while Lo *et al*(16) reported a mean working time of 10.8 minutes. The working group for this study perceived adequate light as an important requirement for a quick and successful work. In most cases where light was not sufficient, working time was prolonged. The working places were under tree shades or under open corridors of school buildings. Heavy shades of trees and cloudy part of the working day reduced the intensity of light to make the vision of working area difficult. Removal of undermined enamel, especially that near the cusps or under/across the transverse ridge of upper molars was also a cause of prolonged working time. Efforts to maintain painless removal of carious dentine did also prolong the working time. This was especially so in cases of very deep carious lesions, whereby excavation had to be done very gently, removing carious dentine bit by bit in order to attain painless excavation.

Although this is an evaluation report of the first year, the success rate is encouraging. The fact that only a few fillings needed replacement show that comprehensive school oral health programme can be easily implemented by ART approach especially in towns where schools are situated in easily reached distances on foot. It is therefore recommended that councils in Tanzania should adopt ART approach in their school oral health programmes to treat dental caries. The use of artificial light, for example, a torch worn on the forehead (face) to improve light on the working area seemed to be an important component for

ART in the field conditions. Cement applicators/plungers is an additional facility that could ensure successful insertion of cement without incorporating air bubbles in a filling. The availability of this instrument facilitated the insertion of cement during this study. It is recommended that for future ART studies, artificial light would be an essential requirement just like a dry working field.

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