

Longitudinal Clinical Evaluation of GIC Restoration Done With Alternative Restorative Technique and Its Comparison with Conventional Class 1 Cavity Preparation

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Abstract

Background: ART is the best and internationally recognized method in camps and setting with limited resources. Even in clinical settings, it is used for their better acceptability among younger children by avoiding sounds and inconvenience of air rotor.

Aim: The purpose of the study was to evaluate the longitudinal clinical success rate of GIC restoration done with ART and its comparison with conventional class I cavity preparation.

Design: 100 children were selected from camps and the OPD of the Department. These were divided into Experimental groups in which 60 cavities were restored

with ART in Camps and the Control group in which 62 cavities were restored using the conventional class I cavity preparation with GIC (KETAC UNIVERSAL) in children attending the OPD of Himachal Dental College, Sundernagar H.P.

Results: After 12 months, the respective survival rates of the restorations were 98.5% and 99.6% respectively for both groups and Ketac Universal GIC had a very high overall success rate of 99% for both the groups combined.

Conclusion: ART and conventional cavity preparation treatment are equally effective for treating class I cavities. So ART Technique can be used as an alternative

restorative technique option to conventional cavity preparation treatment method in special needs.

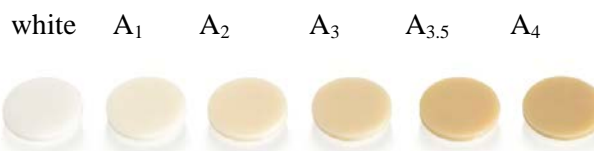
Keywords: glass ionomer cement, Atraumatic restorative treatment, Conventional cavity preparation, dental caries, dentin conditioner.

Introduction

Alternative restorative treatment (also known as INTERRIM THERAPEUTIC RESTORATION) is an effective minimal invasive approach to manage dental caries given by FRENCKEN J and HOLMGREN C.¹ It was introduced as a potentially viable mean of providing restorative and preventive care to a population with limited resources.^{2,3} This alternative restorative approach was pioneered in Tanzania in the mid-1980s as a part of community based oral health program by the University of Dar es Salaam and was presented at the headquarters of the World Health Organization on World Health Day in 1994.⁴ The advantages of ART over conventional cavity preparation are that it doesn't require anesthesia, electrically driven equipment,⁵ rotary dental chair setting. In the recent years, there has been increased interest of ART also known as ITR (INTERRIM THERAPEUTIC RESTORATION) in developed countries for its traumatic approach in relation to stress and pain experienced by patients.⁶ ART is a treatment of choice at times of conducting camps, in children with special needs and for communities with no access of dentists. Also this technique is indicated for patients who suffer from fear or anxiety towards dental treatment and where behavior management is not feasible. It is effective, acceptable and feasible approach for the management of single surface occlusal caries. Because of its simple procedure as minimal intervention technique, ART technique can control dental caries in all people irrespective of their economic and living conditions. Now-a-days the ART

technique is also indicated in oral care of very young children, not previously exposed to dentistry.⁷

Glass ionomer cement is the material of choice for ART Technique. High viscosity ketacTM universal Glass ionomer cement was used in our study as it has excellent sealing on the margins of the filling. It continuously releases the fluorides over 24 months and does not require the conditioner or coating before its placement. Its low cost has increased its interest in underdeveloped countries. It is used for bulk fill placement and available in 6 shades.



Himachal Pradesh is a hilly state of northern India with the population of 7,123,184. 90% of population resides in the rural areas. The traditional diet of Himachal is still raw and unrefined which includes raw and roasted wheat, corns and rice. Hence, the effect of these rough and unrefined diet consumed in rural areas on restoration would be different from the restoration done in the children of urban areas who more often consumes soft and refined diet.

ART is not suitable for all types of carious lesions because ART showed unacceptable high failure rates due to inadequate mechanical retention except in class I cavity where it showed higher success rate.

Hence, the Aim of the present study is to evaluate the effectiveness of ART done by Glass ionomer cement in rural children of Sunder nagar in Himachal Pradesh and to compare this with Glass ionomer cement restoration done with Conventional class I cavity preparation.

Material and Methods

The total of 100 children (122 teeth) were selected from camps and from the OPD of the department of

Pedodontics and preventive dentistry. These children were divided into Experimental group (GROUP I) in which 60 cavities were restored with high viscosity Glass ionomer cement with standard ITR technique in Camps and the Control group (GROUP II) in which 62 cavities were again restored high viscosity Glass ionomer cement using the conventional class I cavity preparation in children attending the department of Pedodontics and preventive dentistry, Himachal Dental College, Sundernagar H.P.

Ethical clearance was obtained from concerned authorities and informed consent was taken from patient's parents prior to the start of the study. Inclusion criteria were Tooth with the Presence of one surface cavity (occlusal surface) involving enamel and dentin only and Cavity opening allowing sufficient excavation with sharp excavating hand instruments (for Experimental group). Teeth with pulp exposure, pain history, presence of fistula, obvious carious cavity but inaccessible to hand instruments (ART), physical/mental disability which limits the dental treatment, general or dental developmental conditions which required specialist care and caries free children were excluded.

122 restorations were restored by using high viscosity ketac universal™ glass ionomer cement in two types of cavity preparation methods. (Figure 1) For Experimental group, after achieving the isolation with cotton rolls, sharp hand instruments were used for gaining access and to excavate the soft caries. All pits and fissures were cleared of plaque and debris as much as possible by using a probe and wet cotton pellet (Figure 2 & 3) and In Control group, after rubber dam isolation, G.V Black class I cavity preparation was done using high speed hand piece with profound water cooling. (Figure 4 & 5) For both the groups, high viscosity ketac universal glass ionomer was used. After cleaning and washing the cavities with wet cotton pellet and dried with fresh pellet, glass ionomer

was mixed as per the manufacturer's guidelines and filled into cavities and then pressed with gloved fingers to push the cement into the deeper parts of the pits and fissures and to overflow the excess material to provide smooth restorative surface. Excess material was removed by carver. (Figure 6 & 7)



Figure 1: Ketac universal glass ionomer cement.



Figure 2: ART procedure during camps.



Figure 3: Pre-Operative and post-operative intra-oral pictures of class I restoration for ART group.



Figure 4: Class I cavity preparation done by conventional cavity preparation method in clinical setting.



Figure 5: Pre-operative and post-operative intra-oral pictures of class I restorations done by conventional cavity preparation.

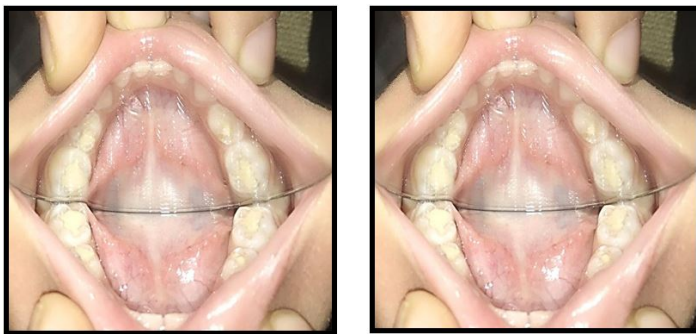


Figure 6: Intra-oral pictures of ART restoration at 6 and 12 months follow up.

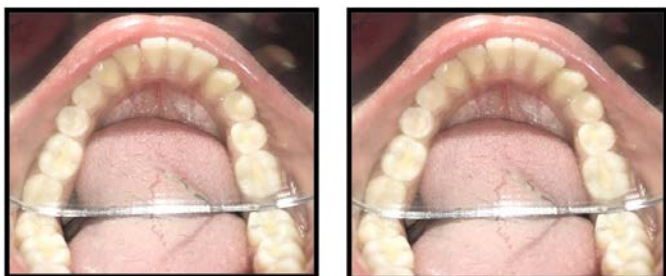


Figure 7: Intra-oral pictures of restoration done by conventional cavity preparation method at 6 and 12 months follow up.

The double blind evaluation were undertaken in a dental unit using the standard operating light, mirror, an explorer and WHO periodontal Probe over a period of 6 and 12 months.

Score	
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, marginal defect for whatever reason, at any one place which is deeper than 0.5 mm, but less than 1.0 mm: repair is needed
3	Present, gross defect of more than 1.0 mm in depth: repair is needed
4	Not present, restoration has (almost) completely disappeared: treatment is needed
5	Not present, other restorative treatment has been performed
6	Not present, tooth has been extracted
7	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
8	Present, wear and tear gradually over larger parts of the restoration which is deeper than 0.5 mm: repair is needed
9	Unable to diagnose

Different scores and clinical criteria were given after evaluating the restorations:

The clinical criteria like Marginal defects, gross defects of restoration, breakage of restoration, wear and tear, post-operative pain and swelling were used to evaluate ART and conventional restorations at the intervals of 6 months and 12 months.

The data was recorded and analyzed using the SPSS 8.0 analysis software by Chi-square test.

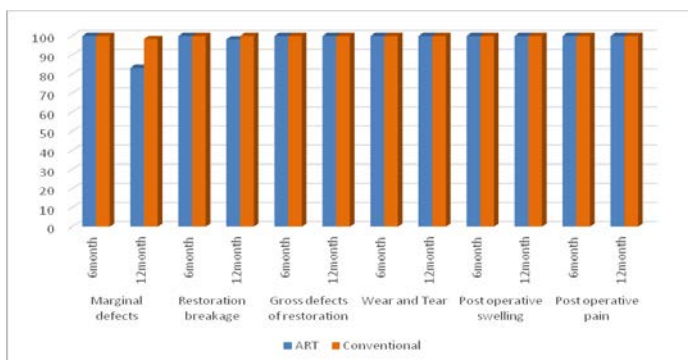
Results

In total 122 restorations, 60 ART and 62 conventional were placed in 100 children. After 6 months, 60 ART and 62 conventional restorations were reviewed and after 12 months 109 restorations were examined. Rest of the restorations was excluded at 12 months follow up because of failure at 6 months follow up. After 6 months, 100% success rate was found in both ART and conventional treatment cases but at 12 months follow up success rate was declined to 83.3% in ART group and 95.2% in conventional treatment group in marginal defects which was statistically significant (4.48 $p = 0.04$). In case of breakage of restoration, 100% success rate was found in both types of treatment groups while at 12 months follow up success rate reduced to 98.3% in ART group and no breakage was found in conventional treatment group. In other parameters like gross defects of restoration, wear and tear, post operative pain and swelling 100% success rate was found at 6 and 12 months follow up in both types of treatment groups which was not statistically significant. (table 1 & graph 1)

Overall success rates of both ART and conventional treatment are presented in table 2 which showed 100% success rate at 6 months follow up in both treatment groups but at 12 months follow up, success rate of 96.9% in ART and 99.2% in conventional treatment group respectively was found

Parameter	Treatment type (N)	6-month follow-up		12-month follow-up	
		Success Rate		Success Rate	
		N	%	N	%
Marginal defect	ART (60)	60	100	50	83.3
	Conventional (62)	62	100	59	95.2
Breakage of restoration	ART (60)	60	100	59	98.3
	Conventional (62)	62	100	62	100
Gross defects of restoration	ART (60)	60	100	60	100
	Conventional (62)	62	100	62	100
Wear and Tear	ART (60)	60	100	60	100
	Conventional (62)	62	100	62	100
Post-operative pain	ART (60)	60	100	60	100
	Conventional (62)	62	100	62	100
Post-operative swelling	ART (60)	60	100	60	100
	Conventional (62)	62	100	62	100

Table 1: Comprehensive representation of success rates for all parameters measured in ART and Conventional treatment at 6 and 12 months follow up.



Graph 1: Comprehensive representation of the success rates of ART & conventional treatment in terms of various study parameters at 6 months and 12 months follow up.

Treatment type	6 months Follow-up	12 months Follow-up	Follow-up Periods combined
ART	100	96.9	98.5
Conventional	100	99.2	99.6
ART and Conventional combined	100	98.1	99.0

Table 2: Overall success rate treatments. Values are expressed in percentage.

Discussion

The use of ART approach has increased and advocated for use in pediatric, general clinical practice, and for field. It has also been used in other populations, including the home bound elders and people living in nursing home (Pilot 1999).⁷ WHO recognizes ART as a part of the package of oral health care for the community.⁸ It views ART as an innovative highly effective approach suitable for population at all levels of economic development which fits the modern concepts of preventive and restorative oral care, laying stress on prevention and minimally invasive restorative care.⁹

High viscosity glass ionomer cement have traditionally been the material of choice for ART restoration from 1990 due to their superior physical properties,¹⁰ it's chemical adherence to dental tissue, coefficient of thermal expansion similar to that of a tooth,¹¹ biocompatibility properties¹² and caries protective effect through the release of fluoride^{12,13} which has antibacterial properties^{14,15,16} and potentiates remineralization that may prevent the development of secondary caries.^{17,18,19}

In the present study, we attempted to evaluate the success rate of high viscosity ketacTM universal glass ionomer cement which was used in the restorations done by ART approach in camps and by conventional rotary instrumentation in clinical setting. The clinical status of class I restorations placed using ART and conventional approach was compared at 6 and 12 months which was found to be high.

Present study showed no marginal defects i.e. 100% success rate at 6 months follow up (baseline) in case of ART and conventional restorative treatment and after 12 months follow up, success rate was reduced to 83.3% in case of ART and 95.2% in case of conventional treatment which was statistically significant in our study. Similar results were seen in the studies done by Fascin ES et al. (2009)²⁰, Yu C et al. (2004)²¹, Bresciani E et al. (2005)²² and Holmgren CJ et al. (2000)³ whereas study done by Wang L et al. (2004)²³, Sacramento PA et al. (2014)²⁴ and Mallow PK et al. (1998)²⁵ found only 71.8% , 76% and 76.3% success rate of ART restoration at 1 year follow up respectively. They described the low success rates in their studies were because of the marginal defects which probably could be due to the material used, technical factors like that the material was not spread to adjacent non carious pits and fissures while placing the restoration, the inexperience of the operators, improper handling of the material, lack of retention in prepared

teeth, clinically undetected carious lesions, improper mixing of the Glass ionomer cement, difficulty in inserting the material into the depths of small preparations, unable to achieve moisture control, surface voids during restoration insertion and control of salivary contamination failure in children.

There was no restoration breakage and 100% success rate at 6 months follow up in case of both Class I ART and conventional cavity preparation treatment was seen in present study but at 12 months follow up we found minimum reduction i.e. 98.3% success rate in case of ART and 100% success rate in conventional treatment was found which was statistically non-significant. Regarding gross defects of restoration parameter, there was 100% success rate observed for both treatment categories at 6 and 12 month time intervals in our study. Similarly for wear and tear parameter, present study showed 100% success rate for both ART and conventional cavity preparation treatment at both 6 and 12 month time intervals which was non-significant. Study done by Yu C et al. (2004)²¹ showed 100% success rate at 6 months follow up in both types of treatment but slight reduction of 93.8% in case of class I ART and 89.6% in case of conventional cavity preparation at 12 months interval was seen due to excessive occlusal wear and restoration breakage.

There was no post operative pain and swelling observed in children treated with ART and conventional cavity preparation treatment at both 6 months and 12 month time intervals in present study and hence 100% success rate was observed. However, Bresciani E et al. (2005)²² reported 97.3% success rate of ART restoration at 6 months while de Medeiros Serpa et al. (2017)²⁶ in his study found 89.3% success rate of ART restoration in 12 months follow up. Their restorations have failed as according to them there was poor cleaning of the cavity or

with the depth of the cavity and other one is that the cavity was near to the pulp and it was not clinically detected.

Overall success rate of 100% was found for both ART and conventional cavity preparation at 6 months and 98.1% at 12 month follow up. Total of 99.0% success rate was observed for both treatments on combining the follow up periods of both treatments. Similar results were observed by Ibiyemi O et al. (2012)²⁷ and Phantumvanit P et al. (1996)²⁸.

Cavity preparation for Glass ionomer cement takes approximately 50% longer working time when the ART hand instruments are used than the conventional rotary instruments. Even in our study 40 - 50% more time was taken for the ART procedure than the conventional one. The use of ART hand instruments alone may not provide best of mechanical retention due to inability to clean the cavity fully up to 100 percent.

Frenken JE et al. (1996)²⁹ reported Poor cleaning of the cavity, hand fatigue of the operator during the treatment procedure, complaint of pain post procedure and risk of pulp exposure. Despite the drawbacks, ART can be used as an alternative treatment to conventional cavity preparation treatment with reasonable success as also concluded in our study. ART is the best and internationally recognized method in camps and setting with limited resources. Even in clinical settings, it is used for their better acceptability among younger children by avoiding sounds and inconvenience of air rotor.

Conclusion

The dental profession is at the threshold of the new discoveries. Restorative dentistry is conventionally one of the most fundamental aspects of dental treatment. Development in dental materials, equipments and techniques has transformed both the ART and science of restorative dentistry. Future advancement will certainly continue the evolution of this discipline. Although the

newer, more viscous Glass ionomer cements are recommended by manufacturers as definitive restorations for cavity preparations in primary molars, some clinical problems have become apparent over the short term. Further investigations are also required of methods for the remineralization of shallow open carious lesions as an alternative to restorations, and of longer term clinical studies for the cost effectiveness of the ART approach. Although there is the need for continued evidence based research, the ART approach has clearly demonstrated a very high acceptance by children, and also resulted in the retention of many teeth that otherwise would have been extracted.

Why this paper is important to pediatric dentists:

- Alternative restorative technique can be used in rural areas where treatment facilities are not available.
- Time saving procedure as compared to conventional cavity preparation treatment.
- Can be used in uncooperative patients.

Ethical Clearance: Ethical clearance was obtained from the ethical institutional committee and informed consent was taken from patient's parents prior to the start of the study.

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