

Atraumatic Restorative Treatment (ART) in Pediatric Dentistry

Rafi Ahmad Togoo¹

ABOUT THE AUTHORS

1. Dr. RAFI AHMAD TOGOO, M.D.S.

Associate Professor,
Dept. of Pediatric Dentistry,
College of Dentistry,
King Khalid University, ABHA
Kingdom of Saudi Arabia.

Corresponding Author:

Dr. RAFI AHMAD TOGOO, M.D.S.

Associate Professor,
Dept. of Pediatric Dentistry,
College of Dentistry,
King Khalid University,
P.O Box-3263,
ABHA-61471.
Kingdom of Saudi Arabia.

Email:
drzak786@yahoo.co.in
rafitogoo@gmail.com

Mobile:
+966-5442709996

Abstract

Atraumatic restorative treatment (ART) is an alternative treatment for dental caries and is an easy, low cost and painless restorative technique where soft *infected* dentin is removed with sharp hand instruments retaining the reversible *affected* dentin and the resultant cavity and adjoining fissures are restored and sealed with Glassionomer cement. This technique involves minimal intervention and invasion and can be used for both treatment and prevention of dental caries. Several Studies have shown good results with this procedure because of which this simple but innovative technique is gaining broader acceptance among dentists and ART approach is increasingly being advocated for use in pediatric and general clinical practice, and field use. More recently, ART has become increasingly accepted in developed countries because of its "atraumatic" approach in relation to the stress and pain experienced by patients.

KEYWORDS: Atraumatic restorative treatment, Dental caries, Glassionomer cement, Minimal intervention technique

Introduction

Atraumatic restorative treatment (ART) is an alternative treatment for dental caries used to remove demineralized and insensitive outer carious dentin with hand instruments only. Therefore, no electricity or anesthesia is required and pain, usually experienced in conventional cavity preparation, is kept to a minimum. Originally, ART was developed for use in developing rural countries because it does not require local anesthesia or electricity. ART conserves tooth structure, minimizing trauma, and has been found to reduce pain perhaps due to the creation of smaller cavities. This technique has been found to be useful in children, elderly, special needs patients and those patients with fear and anxiety about dental treatment (1, 2). Pain and anxiety are significantly lower in both children and adults who receive ART therapy compared to conventional therapy (3). Overall, patients feel less fear and discomfort when receiving ART compared to conventional rotary instruments. ART does not require extensive dental equipment. The instruments and materials needed to perform ART are portable. ART can be implemented by properly trained personnel with even non-dental background. ART offers an opportunity for preventive and restorative dental treatment under field conditions where there is lack of electricity and modern dental facilities. ART was developed for use in community and/or field settings and can be used in places where only hand instruments may be available, such as rural settings and developing countries. ART can be useful in an elderly population who may be in nursing homes or confined to their homes where only hand instruments may be available¹⁸. Schools or clinics in the community may benefit from ART programs as well as it requires little set up time and the equipment is portable.

Advantages of ART (4):

- Simple and easy to learn.
- Better patient acceptance
- Not painful and so does not require anesthesia
- No need for extensive equipment
- Low Cost

ART technique can be utilized in the following:

- As a routine procedure in the dental clinic
- In treatment of children with early childhood caries
- In very young children as restoration and as an interim preventive procedure
- As a pit & fissure sealant.
- In uncooperative, apprehensive & nervous young and adult patients (5)
- Field practice in conjunction with portable dental units
- Treatment of cervical caries
- In Mentally & Physically Challenged patients
- In School & community Dental Health Programs

Indications

- Clinically detectable caries involving the dentine.
- Cavity on tooth surface accessible to hand instruments.

Contraindications

- Clinical or radiographic evidence of exposure of the tooth pulp.
- Presence of swelling (abscess) or fistula near the carious tooth.
- History of tooth pain suggesting chronic inflammation of the pulp.
- Obvious carious cavity, but the opening is inaccessible to hand instruments

ART Technique Procedure (6)

Pre-Procedural steps

- Review the procedure before starting.
- Select and arrange the correct instruments and materials.
- Organize a good working environment in and outside the mouth
- Ensure proper sterilization and control of cross infection.

Instrumentation:(7)

Members of the WHO Collaborating Centre for Oral Health Services Research have developed an ART Instrument Set (7) specifically for the ART Technique. A total of 8 instruments are supplied in a complete kit with

or without a carrying case. The numbering system of the instruments corresponds with the ART Manual published by the WHO thus facilitating identification of instruments and making training easier. Each ART set should contain:

1. Mirror
2. Explorer
3. Tweezers
4. Spoon Excavators S.M.L
5. Hatchet
6. Double ended Applier/ Carver instrument
7. Enamel Access Cutter
8. Instrument Tray

Restorative Material:

Glass Ionomer Cement(8) is the material of choice due to its following properties:

- Bio-mimetic material.
- Forms a chemical bond with both enamel and dentine.
- Releases fluoride.
- Antibacterial & Anti-cariogenic.
- Non-irritant.
- Versatile, easy to handle and manipulate.
- Has good strength
- Sets rapidly

As manufacturers are continuously in the process of producing better Glassionomer of improved quality it is suggested that the best type of Glassionomer available should be chosen by the operator for use in the ART procedure.

Consumables

- Vaseline or petroleum jelly.
- Articulating paper.
- Cotton rolls for saliva control.
- Cotton pellets
- Dentine conditioner
- Wedge
- Plastic strip
- Examination gloves
- Chip Blower

Miscellaneous

- Battery power if no electricity is available
- Mouth mask
- Operating light
- Portable dental chair or a flat bed/chair
- Operator and assistant stool
- Surgical spirit
- Instrument forceps
- Soap and towel
- Cloth Sheet
- Sharpening stone and oil

Sterilization Equipment: Pressure cooker/autoclave and heat source or chemical sterilization

Infection control

- Always wear gloves and mouth mask.
- Cleaning and disinfection of the working place and sterilization of instruments is essential to prevent cross infection.
- Cleaning and disinfection of surfaces in the working place can be done by using cotton gauzes impregnated with surgical spirit.
- In a clinic, instruments should be sterilized in an autoclave.
- If not in the clinic in a field situation a pressure cooker or a pan with a lid to boil in minimum of 2 to 3 cms of water for at least 15 minutes before the instruments can be used.
- Dry the instruments with a clean towel and store in a metal tray for further use.
- To avoid the risk of infection by HIV and HBV all instruments must be sterilized before being used for each patient and multiple sets should be available.

Patient position

- A patient lying on the back on a flat surface over the operator's lap at the height of the operator's chest will provide safe and secure body support and a comfortable and stable position for lengthy periods of time.
- The work posture and position of the operator should provide the best view of the inside of the patient's mouth. At the same time, both patient and operator should be comfortable. The distance from the operator's eye to patient's tooth is usually between 30 and 35 cm
- The operator should be positioned behind the head of the patient. The exact position will depend on the area of the patient's mouth to be treated. The direct rear position i.e. at 12 o'clock and the right rear position i.e. at 10 o'clock are the most commonly used positions.

Role of assistant

- Oral care is best provided by a team consisting of an operator and an assistant. However, assistants may not always be available.
- When treating patients alone, particularly children using ART, it is a great advantage if another person can mix the glass Ionomer.
- The operator should first demonstrate the use of instruments and the mixing procedure and train that person until he/she is able to mix the liquid and powder together correctly.

Seating Position of Assistant

The assistant works at the left side of a right-handed operator and does not change position. The assistant should sit as close to the patient support as possible,

facing the patient's mouth. The assistant's head should be 10 - 15 cm higher than the operator, so that the assistant can also see the operating field and can pass the correct instruments when needed. The assistant needs a flat stable surface i.e. a table for holding instruments and materials.

ART Technique:

Step I: Isolation

- A light source natural or artificial, electric or battery operated can be used.
- The tooth to be restored is isolated using cotton rolls.
- The cavity is cleaned with moist cotton pellet and dried using dry cotton pellets or a chip blower in a field situation.

Step II: Excavation of the cavity

- Excavation of the carious lesion is done using a small, medium or large sharp spoon excavator depending upon cavity size and requirement.
- Only soft (infected) dentin is removed leaving behind hard (affected) dentine.
- A hatchet is then used to slice away thin unsupported and carious enamel left after carious dentine has been completely removed.

Identifying carious dentin: The procedure involves the excavation of the outer Caries or Infected dentin that has a heavy bacterial load and the collagen is degraded. It is pale yellow or brown in color, moist and potentially non-mineralisable. The inner caries or affected dentin has few or no bacteria and has to be retained, as it is potentially remineralisable. It is brown black in color, dry and collagen cross-links are intact.

Step III: Filling with GIC

- Glass Ionomer cement is mixed as per manufacturers instructions and carried to the cavity using blunt end of the Applier /carver instrument.
- Insert the mixture in small amounts into the cavity and into the adjacent fissures, using the blunt blade of the applier/carver
- Use round surface of a medium excavator to push the mixture into deeper parts of the cavity and under any overhanging enamel.
- The cavity is finally filled by Press finger technique (6). This involves applying Vaseline or petroleum jelly on the index finger and pressing gently against the GIC until it sets which usually happens in a few minutes.
- A cavity is restored and the adjacent fissures are sealed with glass- Ionomer at the same time. This is called a sealed restoration.

- The finger is removed sideways and visible excess of glass-Ionomer is removed with the sharp end of an Applier /Carver Instrument.
- Wait 1-2 minutes until the material feels hard, whilst keeping the tooth dry.
- Check the bite using articulation paper and adjust the height of the restoration with the applier/carver if needed.
- Apply a new layer of petroleum jelly.
- Remove cotton wool rolls.
- Ask the patient not to eat for at least one hour.

The whole procedure can be accomplished in about 5 minutes

Adhesive restorative material like glass ionomer is used as ART restorative material, which does not require mixing machines and curing lights. The further advantages of this material include chemical bonding to enamel and dentine (9), long-term and slow release of fluoride into enamel, dentine, saliva and plaque (10–13), reduced caries progression in tooth tissues that are in contact with the material (14–18), and pulp-friendly material (19).

Survival rates of restorations using ART vary depending on several factors. In a meta-analysis of studies reporting survival rates of ART restorations, single surface restorations were found to be more successful than multi-surface restorations in both primary and permanent dentition. High viscosity glass ionomer was retained longer than medium viscosity(20).

ART as Pit & Fissure sealants:

Besides being used as a restorative material, glass-Ionomer can also be used as a pit and fissure sealant (8). Studies suggest that Glass Ionomer cements are inferior to resin based sealants as far as long-term retention is concerned but may be highly effective in situations where the use of resin-based sealants may not be indicated as in very young uncooperative child patients, medically compromised adult patients and certain field conditions. Composite resin pit and fissure sealants are used when careful control of moisture can be obtained and GIC is used in primary anterior teeth in very young children until they can tolerate more elaborate and lengthy treatment procedures. Studies (21-23) show Glass Ionomer cements have shown a retention period of over a year (8) and even when glass-Ionomer sealants on the occlusal surface have been partially or completely lost, there is usually a benefit to the patient because the fluoride released from the material and the retention of the cement remnants deep inside the pits and fissures (24, 25) providing some protection against caries.

Technique:

- Isolate the tooth with cotton wool rolls.

- Clean the surface debris with a cotton wool pellet dipped in water.
- Gently remove debris from deepest parts of pit and fissures with an explorer.
- Dry the cavity using cotton pellets or a chip blower if in a field situation.
- Apply dentine conditioner or diluted glass-Ionomer liquid into the pits and fissures for 10-15 seconds.
- Immediately wash the pits and fissures, using wet cotton wool pellets to clean off the conditioner. Wash 2-3 times.
- Dry the pits and fissures with cotton wool pellets /chip blower.
- Mix the glass-Ionomer as per manufacturers instructions and apply it in all pits and fissures with the blunt blade of the applier/carver instrument. Overfill slightly.
- The fissures are filled by Press Finger Technique. Rub some petroleum jelly on the gloved index finger. Put the index finger on the mixture, press and remove finger sideways after a few seconds.
- Remove visible excess of mixture with a large excavator.
- Wait 1-2 minutes till the material feels hard, whilst keeping the tooth
- Check the bite using the articulation paper and adjust the amount of sealant with the carver if needed.
- Apply a new layer of petroleum jelly. Remove cotton wool rolls.
- Ask the patient not to eat for at least one hour.

Monitoring

- Careful monitoring of restorations and sealants is important. Monitoring Restorations and Sealants
- Follow instructions carefully to avoid failures. Avoid high points in the restoration.
- Monitoring is more easily undertaken in schools than in clinics, since students/pupils will normally be available when you visit the school.
- As any serious problems tend to occur soon after the treatment is finished, the first clinical evaluation could take place after half an hour
- Therefore, ask patients about pain felt during and after treatment, and their overall satisfaction within a period of 4 weeks after being treated
- Further evaluations can be planned on an annual or biannual basis depending on factors such as expected caries development, length of time students stay at school and the possibility of seeing the individuals again.

- Further treatment if needed will be based on the clinical assessment of the tooth.

Conclusion

ART was adopted by WHO and by FDI at the annual meeting in Vienna in 2002 and more than 100 scientific publications have been published on ART from all corners of the world. It is an effective treatment approach for routine and special situations where both treatment and prevention of caries is indicated. It makes prevention and restorative treatment more easy and accessible for all population groups with no additional cost or need for extra workforce.

ACKNOWLEDGMENT

The author would like to thank Dr. Zakirulla Meer, Assistant Professor, College of Dentistry, King Khalid University, ABHA, Kingdom of Saudi Arabia for his contribution to this article.

REFERENCES

1. Carvalho, T.S., et al., The atraumatic restorative treatment approach: an "atraumatic" alternative. *Med Oral Patho Oral Cir Bucal*, 2009;14(12):668-73.
2. Rahimtoola, S., et al., Pain related to different ways of minimal intervention in the treatment of small caries lesions. *ASDC J Dent Child*, 2000;67(2):123-7.
3. Mickenautsch, S., J.E. Frencken, and H.M. van't, Atraumatic restorative treatment and dental anxiety in outpatients attending public oral health clinics in South Africa. *J Public Health Dent*. 2007;67(3):179-84.
4. Ivar A. Mjör and Valeria V. Gordan Gainesville. A review of Atraumatic restorative treatment. *Int Dent J* 1999;49:127-131.
5. Frencken J, Songpaisan Y, Phantumvanit P, Pilot T. An atraumatic restorative treatment (ART) technique: evaluation after one year. *Int Dent J* 1994; 44:460-4.
6. Manual for the ART approach to control dental caries. Frencken JE, Evert van Amerongen.
7. GC Asia. Dental-Atraumatic restorative Treatment instruments. Available online.
8. Kevin H-K. Yip et. al. The effects of two cavity preparation methods on the longevity of Glassionomer cement restorations. An evaluation after 12 months. *JADA* 2002;133..
9. Wilson AD, McLean JW. Glass-ionomer cement. Chicago: Quintessence; 1988. p. 107- 3.
10. Retief DH, Bradley EL, Denton JC, Switzer P. Enamel and cementum uptake from a glass ionomer cement. *Caries Res* 1984;18:250-7.
11. Forss H, Jokinen J, Spets-Happonen S, Seppä L. Fluoride and mutans streptococci in plaque grown on glass ionomer and composite. *Caries Res* 1991;25:454-8.
12. Hatibovic-Kofman S, Koch G. Fluoride release from glass ionomer cement in vivo and in vitro. *Swed Dent J* 1991; 15:253-8.
13. Forsten L. Fluoride release and uptake by glass-ionomers and related materials and its clinical effects. Proceedings of 1st European Union conference on glass-ionomers; 1996. p. 17-8.
14. Hicks MJ, Flaitz CM. Caries-like lesion formation around fluoride-releasing sealant and glass ionomer. *Am J Dent* 1992;5:329-34.
15. Ten Cate JM, van Duinen RNB. Hypermineralization of dentinal lesions adjacent to glass-ionomer cement restorations. *J Dent Res* 1995;74:1266-71.
16. Qvist V, Laurberg L, Poulsen A, Teglers PT. Longevity and cariostatic effects of everyday conventional glassionomer and amalgam restorations in primary teeth: three-year results. *J Dent Res* 1997;76:1387-96.
17. Tam LE, Chan G P-L, Yim D. In vitro caries inhibition effects by conventional and resin-modified glass-ionomer restorations. *Operative Dent* 1997;22:4-14.
18. Gilmour ASM, Edmunds DH, Newcombe RG. Prevalence and depth of artificial caries-like lesions adjacent to cavities prepared in roots and restored with a glassionomer or a dentin-bonded composite material. *J Dent Res* 1997;76:1854-61.
19. Hume WR, Mount GJ. In vitro studies on the potential for pulpal cytotoxicity of glass-ionomer cements. *J Dent Res* 1988;67:915-8.
20. van't Hof, M.A., et al., The atraumatic restorative treatment (ART) approach for managing dental caries: a meta-analysis. *Int Dent J* 2006;56(6):345-51.
21. Seppä L, Forss H. Resistance of occlusal fissures to demineralization after loss of glass Ionomer sealants in vitro. *Pediatric Dent* 1991; 13:39-42.
22. Phantumvanit P, Songpaisan Y, Pilot T, Frencken JE. Atraumatic restorative treatment (ART): a three-year community field trial in Thailand—survival of one-surface restorations in the permanent dentition. *J Public Health Dent* 1996; 56(special issue):141-5.

23. Frencken J, Songpaisan Y, Phantumvanit P, Pilot T. An atraumatic restorative treatment (ART) technique: evaluation after one year. *Int Dent J* 1994; 44:460-4.
24. Frencken JE, Makoni F, Sithole WD. Atraumatic restorative treatment and glass-Ionomer sealants in a school oral health programme in Zimbabwe: evaluation after 1 year. *Caries Res* 1996;30:428-33.
25. Frencken J, Makoni F. A treatment technique for tooth decay in deprived communities. *World Health* 1994;478:15-7