Biological Restoration in Pediatric Dentistry: A Brief Insight

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ABSTRACT
Dental caries is the most prevalent disease in humans, especially during early childhood. The restoration of such an extensive carious lesion should be done properly to reestablish their anatomy and hence their masticatory, phonetic, esthetic and space-maintainer functions in the dental arches. The consequences of premature loss of primary teeth are well known, namely the loss of vertical dimension of occlusion, tongue thrusting and mouth breathing habits, which can be the sources of future malocclusion. Satisfactory restoration of these teeth, improving esthetics, along with the management of space and function has always been a challenge for pediatric dentist. An ever increasing demand for esthetics has led to innovation and development of newer treatment modalities for these problems. In an attempt to widen the treatment options as biologically and conservatively as possible, tooth structure is used as a restorative material to rehabilitate severely destroyed tooth crowns. This technique consists of bonding sterile dental fragments, obtained either from the patient or from a tooth bank, to the teeth. Such a technique was termed as 'biological restoration'.

This article aims at reviewing the evolution, techniques and outcome of such biological restorations.

Keywords: Biological restoration, Early childhood caries, Primary teeth, Tooth bonding.

INTRODUCTION
Dental caries is the most prevalent disease in humans, especially during early childhood. Early childhood caries is a major health problem that causes significant pain and psychological trauma to young children. A study on dental caries prevalence among preschool children revealed that caries prevalence is 54.1 and 23% of children had caries in anterior teeth. Early childhood caries is usually presented with extensive multi-surface involvement of teeth. Restoration of extensively destroyed carious teeth has always been a challenge to pediatric dentist. In the past the only option for severely decayed anterior teeth was to extract the affected teeth and then replace them with the prosthetic substitute until the permanent tooth erupted.

Conventional restorative procedures for severely damaged teeth require metallic restoration for posterior teeth and a combination of metallic and esthetic restoration for anterior teeth. With growing general awareness many children even as young as 3 years are becoming conscious of their appearance. The loss of esthetically essential anterior teeth may affect the child’s confidence and its normal personality development. Also it may cause abnormal habits and speech difficulties.

Satisfactory restoration of these teeth, improving esthetics along with the management of space and function has been a challenge for pediatric dentist. In an attempt to widen the treatment options to rehabilitate severely destroyed tooth, as biologically and conservatively as possible, several authors have suggested the use of tooth structure available from tooth bank as restorative material.

The present article is a brief review on ‘biological restorations’ its advantages, disadvantages and clinical techniques. The first paper reporting the use of fragment of extracted teeth as dental restorative material was published in 1964 by Chosak and Eidelman. Later in 1991 Santos and Bianchii used the technique of bonding sterile tooth dental fragment to teeth with large coronal destruction and termed the technique as ‘biological restoration’. Tavares in 1992 first described the technique of biological restoration in primary dentition (Table 1).
Technique of Biological Restoration

For Carious Posterior Teeth (Figs 1 to 6) as Described by K Sanches et al

The first step should be to evaluate the extent of carious lesion both clinically and radiographically. This is followed by local anesthesia and rubber dam placement. Remove all the carious lesions and flatten the cavity walls and margins. Protect the tooth with calcium hydroxide liner and glass ionomer cement base; remove rubber dam and make an impression using irreversible hydrocolloid material. On the stone cast obtained measure the mesio-distal, cervico-occlusal and buccolingual dimensions of the tooth using a compass, in order to select an extracted tooth from stock, whose coronal dimensions best fitted the prepared tooth. Color matching is also taken into account. The tooth which is selected, is decoronated and the coronal fragment is adjusted with diamond points at high-speed under air/water spray coolant until it fits the cavity. Interpose articulating paper between the fragment and the cavity in the stone cast to demarcate the areas that need further adjustments. The prepared fragment is autoclaved at 120°C for 20 minutes.

In the second clinical appointment place a rubber dam check the adaptation of the fragment to the tooth. Etch both the cavity and the fragment with a 37% phosphoric acid gel for 30 seconds, rinse and then dried. According to the manufacturer’s instructions, bonding agent is applied to the cavity and fragment. Adapt the fragment to the prepared tooth and light cure each surface for 60 seconds. The small imperfections are corrected with light-curing composite resin and the occlusion is checked with articulating paper. Fluoride gel is topically applied to tooth surfaces.

For carious anterior teeth (Figs 7 to 13) as described by Ramires et al.

Accomplish endodontic treatment of all the anterior teeth involved in first appointment. In next session, cleanse and prepare the canals to receive intracanal dentin post. Select the natural post (tooth) and prepare it to fit into the roots. Etch both the root canal and dentin post with 37% phosphoric acid for 15 seconds to receive dentin

Table 1: Summary of biological restoration techniques done by different authors

| Authors | Year | Technique | Results |
|---------|------|-----------|---------|
| Santos J, Bianchi J | 1991 | Biological Restoration of severely damaged teeth with resin bonding systems: case reports | Biological restoration has better sealing and provides no microleakage around the restoration. It has better long-term esthetics and offer more treatment options at difficult clinical problems |
| Ramires-Romito ACD et al | 2000 | Biologic restoration of primary anterior teeth | Biologic restoration shows desirable esthetics and good cervical adaptation |
| Mandrol PS | 2003 | Biologic restoration of primary anterior teeth: a case report | Biologic restoration preserves the integrity of patients natural dentition |
| Barcelos R et al | 2003 | Biological restorations as an alternative treatment for primary posterior teeth | Biologic restoration shows satisfactory retention, esthetics and mastication. |
| Sanches K et al | 2007 | Biological restorations as a treatment option for primary molars with extensive coronal destruction—a report of two | Biologic restoration is clinically applicable, viable, cost effective restorative procedures for severely damaged primary crowns |
| Grewal N, Reeshu S | 2008 | Biological restorations: as an alternative restorative treatment for severely mutilated primary anterior teeth | Biological restorations is a successful, cost effective alternative esthetic treatment for restoration of severely mutilated primary anterior teeth |

Fig. 1: Primary molar with carious lesion

Fig. 2: Impression and working model of the prepared cavity
Fig. 3: Selected tooth from the tooth bank is adjusted to fit the prepared cavity on the model

Fig. 4: Application of etchant

Fig. 5: Application of bonding agent

Fig. 6: Postoperative finished restoration

Fig. 7: Anterior tooth with extensive caries

Fig. 8: Anterior tooth after endodontic treatment

Fig. 9: Selection of tooth from tooth bank and modified to fit to the endodontically treated tooth

Fig. 10: Application of etchant
adhesive. Using dual cure adhesive material cement the dentin post to the root canal. A nonretentive preparation is made ending in chamfer shoulder type margin with rounded corners. Cemented post is protected with the provisional material till next session.

A silicon impression of the prepared teeth is taken to aid in selection of natural crowns in the tooth bank. After autoclave sterilization the prepared crown is cemented with dual cure resin composite. The cervical margins of the restoration is polished with rotary instruments and resin composite polishing disks.

Indications

- Extensive carious lesion;
  - Insufficient tooth surface to retain amalgam/composite restoration
  - Children with rampant caries
- Following pulpal therapy as an alternative treatment to stainless steel crown/composite resin.

Advantages

As reported by different authors are as follows:

- The technique is simple, allows the preservation of sound tooth structure and provides excellent esthetics compared to composite resins and stainless steel crowns, especially regarding translucency.

- Allows the maintenance of pulpal vitality.
- Has a low cost.
- Using tooth fragments as restorative material offers superficial smoothness, cervical adaptation and physiologic wear compatible with those of surrounding teeth.
- Biological restorations not only mimic the missing part of the oral structures, but are also biofunctional.
- Clinical chairtime for fragment bonding procedures is relatively short, which is very interesting when treating pediatric patients.
- Restoration is less subjected to extrinsic pigmentation and plaque accumulation when compared to composite resin.

Disadvantages

As reported by different authors are as follows:

- Though it requires a short clinical chair side time as any indirect restorations, biological restorations require a laboratorial phase that may become a critical step if not properly handled.
- In spite of being simple, the technique requires professional expertise to adequately prepare and adapt the natural crowns to the cavity.
- Difficulty in obtaining teeth with the required coronal dimensions.
- Difficulty in matching fragment color with tooth remnant color.
- Also, having fragments from other people’s teeth in their mouth is not a pleasant idea for some patients and many of them refuse to receive this treatment.
- Technique is considered difficult for UG students.
- The use of very thin fragments where all the dentin is removed lowers the fracture resistance of bonded fragment.
- Availability of tooth from tooth bank. (K Sanches et al 2007).

However, all these factors are not contraindications of the technique.
Sterilization of Teeth

The best method for sterilization of extracted teeth has not been defined. Humid steam vapor is the most frequently used technique in biological restoration and most recommended. It has been verified by means of microbiological culturing and SEM that Humid steam vapor is safe method of eliminating microorganism without interfering with fragment bonding.

Other forms of sterilization of extracted teeth are: ethylene oxide and gamma radiation.

Factors to be Considered for Biological Restoration

- Time spent on the dental chair
- Total cost of the treatment
- Possibility for the need for repair
- Acceptability by the patient and parents.

CONCLUSION

There exist no standardized procedures to restore broken down primary anterior teeth to the gingival level. These grossly broken down teeth require a different management solution.

The use of biological restorations over a short composite post provides one of the treatment means. Authors have suggested that not only the children but also the parents are satisfied with the outcome of these restorations.

REFERENCES

1. Kozol J. Savage inequalities: Children in American School. Crown Publisher 1991.
2. Mahajabeen R. Dental caries prevalence among preschool children of Hubli Dharwad City. J Ind Soc Pedodon Preven Dent 2006;24(1):19-22.
3. Kapur A, Chawla HS, Goyal A, Gaube K. An esthetic point of view in very young children. J Clin Ped Dent 2005;30(2):99-103.
4. Tavares AC, Goes WA, Paixao RF, Imparto JCP. Reconstrucao de dente deciduo humano. Relato de Caso. Rev Fac Odontol Sao Paulo 1992;4:113-117.
5. Mosovich H, Creugers NHJ. The novel use of extracted teeth as a dental restorative material. Natural Inlay J Dent 1998;26(1):21-24.
6. Ramires-Romito ACD, Wanderley MT, Oliveira MDM, Imparato JCP, Côrrea MSNP. Biologic restoration of primary anterior teeth. Quintessence Int 2000;31(6):405-411.
7. Chosack ABDS, Eidelman EDO. Rehabilitation of a fractured incisor using the patient's natural crown: case report. J Dent Child 1964;31(1):19-21.
8. Santos J, Bianchi J. Restoration of severely damaged teeth with resin bonding systems: case reports. Quintessence Int 1991;22(8):611-615.
9. Sanches K, Carvalho FK, Nelson-filho P, Assed S, Silva WGP, Queiroz AM. Brazilian Dent J 2007;18(3):248-252.
10. Chu FCS, Yim TM, Wei SHY. Clinical considerations for reattachment of tooth fragments. Quintessence Int 2000;31(6):385-391.
11. Ehrmann EH. Restoration of a fractured incisor with exposed pulp using original tooth fragment: report of a case. J Am Dent Assoc 1989;118:183.
12. Mandrol PS. Biologic restoration of primary anterior teeth: a case report. J Ind Soc Pedodo Prevent Dent 2003;21(3):95-97.
13. Pegoraro CN, Domingues LA, Trassi PPM. Biological onlay: an alternative technique for restoration of severely damaged posterior tooth: a case report. Revista Dental Press de Estética 2006;3:114.
14. Sengun A, Ozer F, Unlu N, Ozturk B. Shear bond strengths of tooth fragments reattached or restored. J Oral Rehabil 2003;30(1):82-86.
15. Busato ALS, Loguercio AD, Barbosa NA, Sanseverino MCS, Macedo RP, Baldissera RA. Biological restorations using tooth fragments. Am J Dent 1998;11(1):46-48.
16. Barcelos R, Neves AA, Primo L, Souza IPR. Biological restorations as an alternative treatment for primary posterior teeth. J Clinic Pediat Dent 2003;27(4):305-310.
17. White JM, Goodis HE, Marshall SJ, Marshall GW. Sterilization of teeth by gamma radiation. J Dent Res 1994 Sep;73(9):1560-1567.
18. Grewal N, Reeshu S. Biological restorations: an alternative esthetic treatment for restoration of severely mutilated primary anterior teeth. Int J Clin Pediatr Dent 2008;1(1):42-47.