Paediatric aesthetic dentistry: a review

ABSTRACT

Aim A number of conditions can lead to aesthetically unacceptable dentitions like dental caries, discoloration, trauma, early loss of teeth, misalignment and any abnormality of shape and size. Today we have a large number of solutions available for aesthetic problems in paediatric dentistry. But the biggest dilemma is: How to choose what is best for a particular patient and that situation? Through this review we try to precisely highlight the various options for aesthetic restorations along with their indications, advantages and disadvantages.

Methods A search and analysis of international works on aesthetics in paediatric dentistry is presented.

Results A considerable number of studies have shown that people are more concerned about missing anterior teeth and their replacement than about posterior ones as aesthetics seems to be more important than function.

Conclusion Dental caries, although not life threatening, causes nagging pain and physical as well as psychological discomfort. Nevertheless, it is clear that the condition is complex and multifactorial and hence it is important to review the various approaches available to restore the lost aesthetics.

Keywords Aesthetics; Paediatric dentistry.

Introduction

Aesthetics is a branch of philosophy dealing with beauty and the beautiful (Merriam Webster dictionary). Therefore we can say that paediatric aesthetic dentistry is a branch that deals with the maintenance and enhancement of the beauty of the mouth of infants and children through adolescence, including those with special health care needs.

Aesthetic restorations

Aesthetic restorations can be intracoronal and extracoronal. Intracoronal restorations for primary teeth include Class III and Class V preparations. The best suitable materials for such restorations are composites and glass ionomer cements (GICs).

Composite resins

These materials (Fig. 1, 2) have been utilised to restore mild to moderate interproximal carious lesions in anterior primary teeth. Due to pulp morphology, dentine and enamel of primary incisors have less retention for...
restorative materials compared to permanent teeth. The depth of cavity preparation becomes very shallow, which may result in insufficient amount of restorative material. Composite resin exhibits minimal toxicity, and the true cause of pulp damage is microleakage [Lee, 2002].

**Resin-modified GICs**
These are also effective restorative materials for Class III restorations. In circumstances where isolation of the tooth to be restored is difficult, particularly with very young children, this is the restorative material of choice. A success rate of 100% has been reported where the resin-modified GIC was placed and maintained in Class III restorations intraorally for 4.5 years [Croll et al., 2001].

**Class V preparations**
Resin-based composite is ideal for Class V restorations (Fig. 3). It maintains color, provides aesthetics and can be bonded to the tooth structure. Adequate isolation is a basic requirement for such a restoration. Due to the young age of some children and associated behaviour management difficulty, it is almost impossible to isolate teeth properly for placement of composite restorations. In these cases glass ionomer cement will be indicated. Croll et al. [2001] reported a success rate of 98% with Class V resin modified glass ionomer cement placed in primary teeth with an average duration of 4.5 years.

**Fiber-reinforced composites**
Fiber-reinforced composites (Table 1) are categorised according to type of fiber, fiber orientation, fiber impregnation and if they are formed by hand or machine.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>FIBER TYPE</th>
<th>FIBER ARCHITECTURE</th>
<th>FLEXURAL STRENGTH (MPA)</th>
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<tbody>
<tr>
<td>FiberKor</td>
<td>Glass</td>
<td>Unidirectional</td>
<td>539</td>
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<tr>
<td>GlasSpan</td>
<td>Glass</td>
<td>Braid</td>
<td>321</td>
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<tr>
<td>Connect</td>
<td>Polyethylene</td>
<td>Braid</td>
<td>222</td>
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<td>Ribbond</td>
<td>Polyethylene</td>
<td>Lenoweave</td>
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**Ribbond’s patented cross-link lock-stitch Leno weave**
- Adaptable and manageable.
- Does not unravel when cut or manipulated.
- Reinforces multi-directionally.
- Durable and impact absorbent.
- Transfers stresses efficiently throughout the fiber network.

**Uses**
- Periodontal splinting.
- Endodontic post and cores.
- Metal-free bridges.
- Single visit bridges.
- Trauma stabilization.
- Orthodontic retainers.
- Maintaining diastema closures.
- Directly bonded bridges.
- Provisional bridges.
- Repairs and problem solving.

**Contraindications**
1. Inability to maintain isolation.
2. Long span.
3. Patients with parafunctional habits.

**Full coronal restorations**

**Stainless steel crowns**
Preformed stainless steel crowns are considered to be the most durable and reliable means for restoring severely fractured or carious primary anterior teeth. Stainless steel crowns are described as easy to place, fracture proof, wear resistant and attach firmly to the tooth until

**Fig. 3** Class V dental caries (A) restored with GIC (B).
exfoliation. The main disadvantage is unsightly metallic appearance. As the population is more conscious of aesthetics, these crowns have become less desirable.

**Resin veneered stainless steel crowns**

To take advantage of the strengths of preformed stainless steel crowns and improve the appearance of treated teeth, the dentist can cut away the cosmetically prominent aspect of the crown, remove enough of the luting cement to leave retentive undercuts, and fill the void with bonded resin composite. Although an improvement over non veneered crowns with their stark, metallic look, crown with resin composite veneers require additional treatment time, and peripheral metal usually can be seen. Extra treatment time can be important if the child has been sedated or is treated under general anaesthesia in a hospital operating room. The preveneered stainless steel crown presents a new option that has important advantages but is not without limitations.

1. The dentist has no choice on the resin shade, and the supplied crowns are sometimes so white that they look artificial in the mouth.
2. The labial section of the margin cannot be crimped, because the bonded resin material will detach. The uncrimped region, therefore, does not fit as precisely as does a nonveneered steel crown.
3. Recording of an alginate impression and preparation of the crowns on a stone cast prior to the appointment time are not always possible, for example, in the case of a child who is to be hospitalised. All fitting procedures and crown form manipulation can be done at the time of operation; non availability of a stone cast does not rule out the use of the preveneered crowns.
4. Crown forms that are tried in, but do not fit, cannot be sterilised under pressure with high heat, because such treatment will destroy the attached resin layer. In this regard, the high cost of each crown to the dentist must be considered.
5. Re-shaping of the resin veneers is often necessary to eliminate the overly convex appearance characteristic of these crowns, and this takes additional laboratory or clinical time.

Another potential disadvantage of preveneered stainless steel crowns for primary incisors is chipping or detachment of the tooth-colored facing. Waggoner and Cohen [1995] reported that Cheng Crowns, Kinder Crowns, and NuSmile Primary Crowns have resin composite facings, and Whiter Biter Crown II has a flexible thermoplastic veneer. In addition, the Cheng Crown and Whiter Biter Crown II include a welded metal meshwork to help to mechanically interlock the veneer on the resin surface. In the others, the veneer is directly bonded to the steel surface. Forces exist that can chip or detach the veneers of any of these crowns.

**Polycarbonate crowns**

They are heat molded acrylic resins used to restore anterior primary teeth. They are contraindicated in cases of severe bruxism, deep bite and excessive abrasion. They do not resist strong abrasion forces. Advantages include less time form placement, easy to manipulate and can be easily adjusted with pliers.

**Strip crowns**

Strip crowns (Fig. 4) have superior aesthetics compared to the other available methods, but they are very technique-sensitive and require a correct patient selection and proper moisture and hemorrhage control. Composite crown relies on enamel and dentin adhesion for retention. Therefore if a lot of tooth structure is absent the longevity of the crown is jeopardised. Additional retention can be achieved by using mini pins [Carranza and Garcia-Godoy, 1999]. Judd, et al. [1990] used short posts in 92 pulpectomised anterior teeth to test retention of strip crowns which showed no failure of retention during one year period.

**Pedo jacket crowns**

The jacket is made of tooth colored polyester material which is filled with resin and left on the tooth after polymerisation. There are difficulties with this type of crown, since it is available only in one shade which is very white, so matching adjacent non-restored teeth can be very difficult. Also because the crown is made of copolyester, it cannot be trimmed or reshaped with a high speed finishing bur due to the fact that the material will melt to the bur.

**Pedo pearls**

The metal crown form is similar to the stainless steel crown, but is completely coated with a tooth coloured epoxy paint. These crowns are made of aluminum instead of stainless steel because the epoxy coating adheres much better to the former. They are relatively soft and this may create a problem with long term durability. In areas of heavy occlusion the white coating will wear off.

**Artglass crowns**

They are made of bifunctional and new multifunctional methacrylates forming a cross-linked threedimensional polymer. Although it is 75% filled as compared to 85%
filled composite resin, the unique filler materials of microglass and silica are purported to provide greater durability and aesthetics than composite strip crowns. They are available in one shade and 6 sizes for primary central, lateral and cuspid teeth. The vast majority of failures in these crowns is due to bond failure [Updyke, 2000].

Biologic restorations

The term biologic restoration was introduced by Santos and Bianchi in 1991. It is defined as an “alternative technique that uses adhesive capabilities of materials in combination with strategic placement of parts of human extracted teeth”.

The technique of bonding tooth fragments was first proposed to repair permanent teeth with the patient’s own fractured crown [Chosak, 1964]. However, it also has been performed to restore crowns severely destroyed by carious disease, using fragments from another patient. Moreover, extracted permanent teeth have also been employed in removable and fixed prostheses. Natural crowns and roots, obtained from a tooth bank, have been used for several clinical and laboratory procedures. They have been used for space maintenance in children, as a substitute for intracanal metal posts, and as biologic restorations for posterior and anterior primary teeth. Presently, secure methods of sterilisation and storage are available to ensure the safety of a tooth or tooth fragment from a tooth bank [Mandroli, 2003]. The technique is effective, reestablishes function, and represents an alternative to prosthodontic restoration in children. The natural crowns offer outstanding anatomy and aesthetics as well as preservation of natural tooth color. The natural enamel has physiologic wear and offers superficial smoothness and cervical adaptation compatible with those of the surrounding teeth. The length of each appointment is reduced, because the “prosthetic natural teeth” are prepared previously. Resin composite restorations do not present these advantages and can allow staining and plaque formation on their surfaces. Furthermore, it eliminates laboratory processing, reducing costs.

Although the technique is simple, it requires the professional ability to prepare and adapt the natural crowns and intracanal posts. Parents must be informed of, accept, and consent to the use of teeth from a tooth bank. Teeth from a trustworthy tooth bank must be available.

Fragment reattachment

Traumatic injuries most commonly affect maxillary incisors (80% central incisors and 16% lateral incisors) due to their anterior position and protrusion caused by the eruptive process. Reattachment of a tooth fragment (Fig. 5) should be preferable for restoring fractured teeth. There are several advantages in this treatment such as obtaining aesthetic in a single appointment, being a more conservative procedure, obtaining healthy periodontal attachment and maintenance of the original tooth contours and translucence.

The reattachment technique was first described in 1964 by Chosak and Eidelaman. At that time, it was considered as a provisional restoration due to the low bond strength values achieved by the adhesive systems. However, the remarkable advancement of the adhesive systems and resin composites has made the reattachment of tooth fragments a procedure that is no longer a provisional restoration, but rather a treatment offering favourable prognosis. This procedure found a strong argument in a conservative philosophy, since it does not require excessive wear of the healthy tooth structure and do not make unfeasible any other later possible restorative treatment.

Prosthodontic replacement of teeth

Teeth can be lost due to various reasons like: caries (Fig. 6), trauma, infection, congenital anomalies (Fig. 7), systemic disorders, premature tooth loss, radiation damage, intrinsic stains, neoplasia. Replacement of missing teeth is essential to establish aesthetics, speech, mastication, integrity of dental arches, health of supporting tissues, prevention of bad habits and for the psychological and mental health of patients. Prosthetic appliances may be either removable or fixed.

When constructing either type, it is best to allow 6-8 weeks of resting period for good healing and gingival retraction.
Alternative prosthetic replacement

The Nance-like device, constructed with two bands or steel crowns on primary molars that are connected by a palatal wire to which replacement teeth are attached, is a fixed appliance, and therefore not easily removed. Its disadvantages are: decalcification around bands, difficult oral hygiene maintenance, bending of wires, frequent recementation.

The Hawley-like device is a removable appliance that utilises circumferential and ball clasps on molars. It requires good compliance from patient, therefore it is not indicated below 3 years of age. Its advantages are: cleaning and removal easy, easy to make adjustments.

Alternative prosthetic replacements have been designed using rare earth magnets, case report on prosthetic replacements using magnets.

Implants

Implants, though widely recommended and used in adults, in children still represent a controversial option. Some children and adolescents have partially or completely edentulous arches due to various reasons such as congenitally missing teeth, syndromes such as ectodermal dysplasia, anodontia and cleft lip and palate, traumatic tooth loss. Conventional removable prosthesis are used, but they preclude added disadvantages such as requiring patient compliance, alveolar bone resorption, periodontal complications and increased caries rate secondary to wear of removable prosthesis. Early use of implants in such patients may prove beneficial. So it is necessary that clinicians understand the advantages as well as the potential risks involved in placing implants in a growing child.

The following factors must be considered before the placement of implants in children.

Growth

One of the main factors which lead to questionable prognosis of implants in children is growth. The growth of the jaw bones as a result of displacement via sutural growth does not affect the implant as the implant will move with the bone. But bone growth resulting from bone remodeling (cortical drift) will have a detrimental effect on the position of implants as it is not followed by the implant.

Adjacent tooth germs

Placement of implants in mixed dentition period can have deleterious effects on the adjacent tooth germs. According to Thilander et al. [1992], adjacent tooth germs may undergo morphologic changes and disorders of eruption. They interfere with position and eruption of adjacent teeth and thus cause trauma to the patient [Rossi and Andreasen, 2003].

Bone quality

According to Bregendal et al [1991], the major risk factor for failure of implants is low quality of bone and small dimensions of mandible in children.

Difficulty in determining ideal timing

The identification of the ideal time for implant treatment in children seems quite difficult, because many different aspects have to be considered while finding the best individual treatment strategy. It seems clear that placement of implants in children with ectodermal dysplasia must be a team effort between surgeon, prosthodontist, orthodontist and periodontist. In younger ages, additionally, a paediatric dentist might also be required.

According to Osterle [2000], the safest time for placement of implants is at the lower portion of
adolescent growth curve or near adulthood. Dental implants should be placed in children and adolescents with extreme caution. As far as possible implant placement should be avoided until cessation of growth and the risks and the benefits involved should be explained to the parents.

Post and core

A post and core is needed to improve retention, to distribute stress and to improve resistance to root fracture. The post interlocks the two fragments and minimises the stresses on the remaining tooth structure that is replaced. The use of fiber-reinforced composite resin post (Fig. 8) has demonstrated negligible root fracture. In addition, fiber-reinforced posts can be used with minimal preparation because they exploit undercuts and surface irregularities to increase the surface area for bonding, which reduces the possibility of tooth fracture during function or traumatic injury. Some types of posts are also used in the primary dentition like the Omega loop post (Fig. 9).

Microabrasion

It is a conservative, non-restorative method of removing intrinsic superficial discoloured dysmineralisation defects [Croll, 1997]. Ideally, the correction of enamel discolouration should cause no significant loss of tooth structure, no damage to the pulp and periodontium, should be well tolerated by the patient and easy for the dentist to perform in a reasonable time with permanent result. It is indicated for the correction of white and brown spots and streaks caused by fluorosis, post-orthodontic demineralisation, surface hypoplasia due to trauma to a primary predecessor, and discoulouration limited only to the outer enamel layer. It is contraindicated in case of uncooperative patient, of sensitivity to heat, cold and acidic fluids and of deep hypoplastic lesions. Acid microabrasion is safe, practical, little time consuming, less destructive, does not accumulate plaque, inhibits colonization of S. mutans and does not require local analgesia. However it has some disadvantages, such as dangers of using an acid in mouth and soft tissue injury.

Bleaching

Tooth bleaching is usually of two types: non vital and vital. Its mode of action is based on hydrogen peroxide (which is naturally produced by eyes, liver, serum in low concentrations) that oxidises unattached stains and organic matter when activated by light or heat, but not used close to tooth surface. Hydrogen peroxide is a strong oxidising agent that produces free radicals, hydrogen peroxide anions, and reactive oxygen molecules. It is proposed that these reactive molecules penetrate the tooth and reduce the long chained, dark coloured chromophore molecules into smaller and hence less coloured, more diffusible variants. It is thought that the bleaching solution reaches and enters the superficial dentine. The success therefore depends on the ability of the agent to reach the chromophore molecules and the duration and frequency of the exposure to the agent [Ian et al., 2006].
Non vital bleaching is indicated for endodontically treated non vital teeth that are discoloured, provided that:

› well condensed root canal filling must be present;
› unsatisfactory filling should be replaced;
› pre-operative radiographs and photographs are available for comparison.

Vital bleaching can be chairside, office bleaching, power bleaching and is suitable for mild tetracycline staining, mild fluorosis, sclerosis of pulp chamber/ageing.

The histologic effects of bleaching are mild superficial inflammation, extravasation of erythrocytes and superficial focal haemorrhage were observed with a combination of heat and H₂O₂. Low-grade reversible superficial focal haemorrhage were observed with a combination of heat and H₂O₂. Low-grade reversible pulpal damage with acute inflammation and isolated odontoblastic activity can also be seen.

Nightguard, Home bleaching, Matrix bleaching use a customised tray filled with 10% carbamide peroxide and are indicated for mild fluorosis as adjunct for microabrasion. Over the counter bleaching agents include rinses, paint-on brushes, toothpastes, chewing gums, dental floss, and whitening strips. These products have low concentration of hydrogen peroxide.

**Laser assisted bleaching**

Carbon dioxide, argon and diode lasers are most commonly used. A new type of laser called KTP laser is getting more and more popular. It is mostly used in plastic surgery (e.g., removing tattoo, haemangioma, and melanosis). KTP (Karium-Titaniun-Phosphoric acid), is a type of Nd:YAG laser. Fluoride gel should be applied after 30s of bleaching [Kinoshita, et al. 2009].

**Complications**

› Cervical resorption.
› Sensitivity.
› Reversal of color.
› Teeth darken over time [Ian et al., 2006].

**Effect of bleaching on restorations**

**Composite resins**

It can cause increase in roughness, porosities, decrease in surface microhardness, fracture toughness, adsorption of salivary proteins, reduction of enamel composite bond strength.

**Glass ionomer**

It causes surface degradation, softening, increased fluoride release and setting of cement is inhibited due to oxygen release [Attin, Hannig and Wiegand et al., 2004].

**Veneering**

It is indicated for moderate to severe staining and is mostly used for maxillary anteriors. Advantages include less cost and minimal preparation. The advantages of laboratory constructed veneers, also known as indirect veneer technique, include less chairside time and excellent aesthetics; their disadvantages are that it takes two appointments to complete, lab expenses increase the cost and there is possibility of excessively bulky material. Direct veneers are constructed directly in the mouth. Advantages include improved marginal adaptation, one appointment, less cost, greater control. Disadvantages include more time, patience and skill requirement.

**Conclusion**

Through this review we try to bring together the various aesthetic approaches for a pediatric patient. Each technique and material carries its own advantages and disadvantages. The selection of a particular procedure or product depends on the clinician’s preferences and patient requirements.

**References**