PEDIATRIC ENDOdontics- ENDodontist’s view
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Abstract:
The dental diseases affecting the pulp and periapical tissues in the primary and permanent dentitions pose treatment challenges for the endodontists because of the vast variations in these dentitions basically due to factors like longevity of primary teeth, coronal structure and root canal morphology and anatomy of the teeth which needs to be critically analysed before rendering treatment. In recent years, new materials, equipments and instruments have evolved to a great extent and simplified the endodontic treatment procedures for the clinicians.

The aim of this article is to highlight the clinical techniques and treatment considerations in treating the vital and non-vital as well as emphasize on surgical management of cases.

Key Words: Pediatric Endodontics, Partial Pulpectomy, pulpotomy.

Introduction:
A number of factors are involved in the development of pulp and periapical disease in primary and permanent teeth, with dental caries being the main factor. Although these factors are similar, the clinical management of a primary or permanent tooth with pulp or periapical disease may be quite different. This is based mainly on the differences between the two types of teeth, with primary tooth longevity, coronal structural integrity, root canal morphology, and root anatomy (Hibbard & Ireland, 1957) being important features to be taken into account when planning the treatment (Table I & II).

The diagnosis of pulp disease is especially difficult in young patients because they are usually unable to give an accurate account of their symptoms. The diagnosis is dependent on the combination of a good history, clinical and radiological examination and special tests. According to Camp (2008), primary teeth with history of spontaneous pain should not receive vital pulpal treatment and are candidate for pulpectomy or extraction. Electric pulp tests and thermal tests are not reliable on primary tooth. Doppler flowmetry might be of great help in determining vitality (Evans et al, 1999). Interpretation of radiographs of primary teeth is always complicated by the presence of the succedaneous tooth and surrounding follicle, resulting into misdiagnosis.

The treatment of primary and permanent teeth has changed dramatically in recent years as new

<table>
<thead>
<tr>
<th>Tooth Anatomic Features</th>
<th>Primary teeth</th>
<th>Permanent teeth</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall size</td>
<td>Smaller</td>
<td>larger</td>
<td>---</td>
</tr>
<tr>
<td>Pulp chamber</td>
<td>Larger as compared to crown</td>
<td>Smaller as compared to crown</td>
<td>Ease of access opening</td>
</tr>
<tr>
<td>Cervical constriction</td>
<td>Marked constriction</td>
<td>Less constricted in Lateral cervical region</td>
<td>perforation</td>
</tr>
<tr>
<td>Root trunk</td>
<td>Short with thin floor of pulp chamber</td>
<td>Large with thicker floor of pulp chamber</td>
<td>Easy furcation involvement.</td>
</tr>
<tr>
<td>Root anatomy</td>
<td>Thin, slender (ribbon shaped), flared</td>
<td>Thicker, not flared</td>
<td>Limitation in canal enlargement, Instrument breakage, Perforation</td>
</tr>
<tr>
<td>Accessory canals</td>
<td>Present frequently in furcation area and roots</td>
<td>Comparatively less in number</td>
<td>Incomplete pulp extirpation</td>
</tr>
</tbody>
</table>

Table I: Anatomic differences between primary and permanent teeth and its significance from pediatric endodontics point of view.

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People’s Journal of Scientific Research

Vol. 4(1), Jan. 2011
materials have been developed. Therapy for children has a high rate of success with less post-operative discomfort. Because of the formative state of the pulp, vital procedures heal nicely with good dentin bridging. On the other hand, internal resorption commonly occurs from pulpal inflammation in a primary tooth.

**Vital Pulp Therapy:**

**Indirect pulp capping:**

Indirect pulp treatment is recommended as the most appropriate procedure for treating primary teeth with deep caries and reversible pulp inflammation. However, newer research appears to be directed towards the use of glass ionomer cements (Massara et al, 2002). Pulp capping with resin composites in monkeys produced the lowest incidence of bacterial microleakage, pulp inflammation and incidence of pulpal necrosis when compared with calcium hydroxide and glass ionomer cement (Cox & Suzuki, 1994).

**Direct pulp capping:**

Direct pulp capping of a carious pulp exposure in a primary tooth is not recommended as treatment failure might result in internal resorption or acute dentoalveolar abscess. In case of inadvertently exposed pulp, free of oral contamination, calcium hydroxide medicament can be used as it maintains the pulp vitality (Fuks, 2005). Presently, direct pulp capping should still be looked on with some reservations in primary teeth. Caicedo et al (2006) demonstrated good pulp response in primary teeth after direct pulp capping or pulpotomy with MTA (Mineral Trioxide Aggregate) and concluded that MTA might be a favourable material for pulp capping and pulpotomy in primary teeth.

**Pulpotomy:**

Pulpotomy and partial pulpectomy techniques for devitalized primary teeth have been developed to preclude an almost impossible obturation problem. Pulpotomy is still the most common treatment for cariously exposed pulp in symptom free primary molars. Formocresol has been a popular pulpotomy medicament in the primary dentition for the past 70 years since it is introduction by Sweet in 1932 (Vij et al, 2004). Nevertheless several studies have reported that the clinical success of FC pulpotomies decreases with time, and the histologic response of the primary pulp is “capricious” ranging from chronic inflammation to necrosis (Rolling & Thyrlstrup, 1975). Presently, there are several pulp dressing medicaments that have been proposed that are equal to if not better than, Formocresol and can be used as alternatives to pulpotomies in primary teeth. These include: electrosurgery (Fishman et al, 1996), laser (Elliot et al, 1999), glutaraldehyde (Araujo et al, 1995), calcium hydroxide (Huth et al, 2005), freeze dried bone (Fadavi & Anderson, 1996).

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### Table II: Histological differences between primary and permanent teeth and its significance

<table>
<thead>
<tr>
<th>Tooth Anatomic Features</th>
<th>Primary teeth</th>
<th>Permanent teeth</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apical foramen</td>
<td>Enlarged</td>
<td>Constricted</td>
<td>Abundant blood supply - exaggerated inflammatory response</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Degeneration of neural elements - less sensitive to operative procedures</td>
</tr>
<tr>
<td>Pulp function</td>
<td>Formative, Nerve supply, Nutritive, protective, and Resorptive</td>
<td>Formative, Nerve supply, Nutritive, and protective</td>
<td>Incidence of reparative dentin formation is more</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>More chances of spread of infection – space involvement (Cellulitis)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Less sensitive to operative procedures</td>
</tr>
<tr>
<td>Cellular response to injury</td>
<td>More extensive</td>
<td>Lesser</td>
<td></td>
</tr>
<tr>
<td>Localization of infection and inflammation</td>
<td>Poorer</td>
<td>Better</td>
<td></td>
</tr>
<tr>
<td>Density of innervation</td>
<td>Less</td>
<td>More</td>
<td></td>
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<td></td>
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<tr>
<td>Pulp nerve fibres</td>
<td>End at the odontoblastic layer</td>
<td>Terminate among the odontoblasts and even beyond the predentin</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Inflammatory response to Calcium hydroxide</td>
<td>Severe</td>
<td>Not demonstrated</td>
<td>Subsequent metaplasia with resultant internal primary root resorption</td>
</tr>
</tbody>
</table>

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**Non-Vital Pulptherapy:**

Pulpectomy-

Non-vital primary teeth may be retained successfully when pulpectomy procedure is employed. A single visit or two-visit pulpectomy may be undertaken. Primary molar roots are severely curved and the pulps are flat and tortuous with numerous branches and interconnections. This necessitates modifications in biomechanical procedures. The root canals are cleaned and shaped and subsequently filled with resorbable paste (Zinc oxide eugenol, or calcium hydroxide or iodoform base). Recently investigators have found that Vitapex (a mixture of calcium hydroxide and iodoform) has superior success rate to that of traditionally used zinc oxide eugenol (100% versus 78.5% at 16 months) and is removed more readily if extruded through an apex (Mortazavi & Mesbahi, 2004).

**Treatment Modalities for Young Permanent Teeth:**

Apexification and apexogenesis-

When providing treatment for patients with mixed and young permanent dentitions, certain clinical scenarios may require interdisciplinary consultation and intervention such as following traumatic injuries and whenever permanent teeth require endodontic therapy. Young pulps in immature permanent teeth are larger than at a more mature stage. Immature permanent teeth have funnel shaped apical foramina which are commonly called “blunderbuss”. Walls of root canal are very thin in newly erupted immature teeth which are further weakened during the cleaning and shaping procedures (Fig. I). The relatively thin dentin walls of the large obturated canals place the tooth at greater risk for root fracture over time. In these instances, the treatment objective is to maximize the opportunity for apical development and closure, known as apexgenesis or apexification, and enhance continued root dentin formation. Figure 1 shows a case of non-vital 45 with open apices of an old female child who reported to clinics with a complaint of decayed teeth. In the following case root canal was cleaned and calcium hydroxide was placed within 1-2mm of root apex to encourage either root growth or apical repair (Fig. II). Recent studies suggest 3 monthly change of Calcium hydroxide (Mackie, 1998). Hence Calcium hydroxide dressing was changed every 3 months and radiographic follow up was done at 1,3,6,9 months. After the barrier was evident radiographically (Fig. III) and clinically, the tooth was reisolated and opened for final obturation of canal with gutta-percha (Fig. IV).

The current data available on the use of MTA in vital pulp therapy indicate that it is the optimum material and better than the traditionally used material calcium hydroxide. It has a better long term sealing ability and stimulates a high quality and a greater amount of reparative dentin and has also demonstrated a high success rate (Witherspoon, 2008).
If attempts to induce root end closure are unsuccessful with persistent sinus tract, it calls for surgical intervention. With mutual consent of parents the procedure can be carried out under sedation or general anesthesia. Root canal filling procedure is completed prior to surgical opening and removal of apical filling, followed by root end closure with MTA.

Recent Advances:

Pulp revascularization and Stem cell research holds great hope for the future and can be considered as novel treatment modalities for the management of primary and young permanent teeth (Banchs & Trope, 2004).

Conclusion:

A successful pediatric endodontic outcome should be based on (1) re-establishment of healthy periodontal tissues; (2) freedom from pathologic root resorption; (3) maintenance of the primary tooth in an infection-free state to hold space for the eruption of its permanent successor; (4) in the case of young permanent teeth, maintenance of the maximum amount of noninflamed portions of pulp tissue to enhance apexogenesis and root dentin formation. With adherence to sound principles in case selection and techniques, pediatric pulp therapy is a major health benefit to the child. The treatment modalities and medicaments that have been discussed, highlighting the most substantiated and qualifying those that need further confirmation by additional research. The clinician must realize that these recommendations are not absolute and will continue to be modified.

Bibliography:


