

## Review Article

### Diagnostic Techniques in Paediatric Dentistry: A Comprehensive Review

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#### ABSTRACT:

Diagnosis of any disease or lesions is a multistep procedure involving various techniques and adjuvants. It is an accomplished art to develop a communication with the child and elicit relevant information from him. Hence; we planned the present review to highlight various oral diagnostic techniques used in paediatric patients planned to undergo dental check-up and treatment.

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#### INTRODUCTION

Children are different from adults in term of physical, emotional and psychological maturation and childhood is the most significant period of growth and development. Dentists currently use visual, tactile and radiographic information to detect changes in the dental hard tissues. The patient assessment forms the essential basis of treatment. Good patient's history and careful examination are important to establish the correct diagnosis and provide appropriate treatment. This is divided into an extra-oral and intra-oral examination.<sup>1, 2</sup>The extra-oral examination is carried out first as this can fundamentally influence the treatment options. The skeletal pattern, soft tissue form and the presence or absence of habits must all be taken into account. The physical examination begins with an extraoral examination to identify possible lesions (such as rash, erythema, and pigmentation), swelling or facial asymmetry. The head and neck should be palpated to identify any tenderness, masses and lymphadenopathy. All muscles of mastication and temporomandibular joint should be palpated for tenderness; patients should be asked to open and close the mouth multiple times to evaluate any limited opening, deviations or asymmetries.<sup>3,4</sup>

#### ROUTINE DIAGNOSTIC AIDS

The clinical intraoral examination is performed systematically in a clean, dry, well-illuminated mouth using the mouth mirror, explorer and periodontal probe. Specialized diagnostic aids: These are used for the

diagnosis of specific dental problems like detection of dental caries, pulpal diseases and orthodontic problems.<sup>5</sup> Advanced diagnostic technologies are increasingly playing a more vital role in this process, both in data collection and assessment capabilities, and the utilization of the information obtained. Diagnostic modalities available to clinicians today expand greatly on the foundation of a comprehensive visual assessment, which has been and will be the cornerstone of the diagnostic process.<sup>6</sup>

The armamentarium for the intraoral examination includes mirror, explorer, gauze, and periodontal probe. Additional materials are disclosing solution, dental floss, toothbrush, and scaler. The intraoral examination begins with an excursion around the oral cavity, noting its general architecture and function. The fingers should be used to identify soft tissue abnormalities of the cheeks, lips, tongue, palate, and floor of the mouth before instruments are placed in the mouth. Children in this age group often permit oral inspection with "just fingers," and the dentist can use this technique as a springboard to obtain cooperation for the use of mirror and explorer. The mirror should be the first instrument introduced. This is usually readily accepted by the child owing to its familiarity and nonthreatening shape.<sup>5-7</sup>

Young children are sometimes uncooperative. If they are, a decision must be made early about how to manage the behavior. Parental assistance can be used to obtain an examination of the oral cavity. Use of physical restraint by the dentist without parental consent is risky and is not

advisable. Parents are more likely to accept restraint in conjunction with an emergency examination than with a routine examination. An important portion of the intraoral examination is directed to the teeth. Each of the 20 primary teeth should be explored and scrutinized visually. Selective periodontal probing may be performed, but the yield is likely to be minimal because of the infrequency of irreversible attachment loss in the primary dentition.<sup>8</sup>

### **Occlusal Evaluation**

Another portion of the intraoral examination is the systematic analysis of the occlusion in three spatial planes. In addition, each dental arch is analyzed individually to describe arch form and symmetry, spacing and crowding, and the presence or absence of teeth. Arch analysis is best performed on diagnostic study models; however, diagnostic casts are usually not indicated in this age group unless there is some need to further study the intraoral findings or if tooth movement is contemplated.<sup>9</sup>

### **Alignment**

Dental arches can be categorized as either U shaped or V shaped. The mandibular arch is normally U shaped, whereas the maxillary arch can be either shape. The dental arch should be symmetrical in the anteroposterior and transverse dimensions. Individual teeth are compared with their antimeres to determine if there is anteroposterior or transverse symmetry.<sup>9</sup>

### **Methods of Clinical Diagnosis Examination of Dental Caries**

Both the overall decline in the prevalence of caries and the greater reduction in the prevalence of smooth-surface caries are well documented. Epidemiological surveys since the early 1970s have shown age-specific reductions in the prevalence of caries, particularly in children of all ages, and evidence of a cohort effect into adulthood. A 50% reduction was documented for 17-year-olds over the period 1971–1985. The reported decline in proximal involvement of decayed and filled posterior teeth has revealed a shift away from smooth-surface caries and has implications for the causal role of fluorides. The greater reduction in smooth-surface caries has resulted in an increase in the proportion of primary caries in susceptible pits and fissures. Decay on occlusal surfaces currently accounts for the majority of new lesions in the dentition of the younger, post-fluoride generation.<sup>7</sup>

### **Clinical Method (Visual-Tactile Method)**

Caries occur when the tooth surface is damaged due to prolonged exposure to acids. These acids can arise from bacteria, or from our diet. The destruction of the tooth structure (dentine, enamel, and finally the pulp) leads to irreversible pathological changes in the tooth, which can be detected by visual inspection or by the sense of touch. Ideally, dentists should look out for good visual indicators that involve features which are purely associated with caries itself. This is to prevent misdiagnosis and confusion over the patient's oral health condition.<sup>8</sup>

The initial stage of caries is the dissolution of surface enamel crystals, leading to a change in its optic behaviour. Healthy enamel should be slightly translucent, but partially dissolving enamel is opaque. Dissolving enamel is more porous due to the acidic effect on the tooth, and hence scatters more light to give rise to its opaque appearance.<sup>9</sup>

The difference between air's refractive index (1.00) and that of hydroxyapatite (1.66) (the substances which enamel is made of) is larger than that between hydroxyapatite and water (1.33). This means that a mildly demineralised tooth covered with water might not appear opaque, but might appear so when it is air dried. In other words, a lesion that has to be dried before opacities are observed has lost less minerals than a tooth which appears opaque even when wet.<sup>7</sup>

### **Combined Visual and Radiographic Diagnosis**

An investigation of the validity of diagnosis by means of optimal bite-wing radiography combined with careful visual clinical examination has shown that the majority of carious lesions and nearly all sound teeth can be correctly identified. The validity of each diagnostic method (visual and radiographic), used separately and together, was investigated for extracted teeth with questionable or borderline caries. Together, these methods had a sensitivity of 75% and a high specificity (90%), fulfilling the current recommendations to provide diagnoses that reduce the risk of unnecessary operative intervention when diagnostic uncertainties exist. However, the 75% sensitivity indicates that there remains a significant risk of missing early dentinal lesions, in teeth with non-overt disease, when conventional visual and radiographic diagnostic methods are used. Some diagnostic uncertainty is inherent in health care, and optimal patient care decisions should take into account all patient factors, including the probability of disease and the relative risks of delaying treatment versus undertaking unnecessary operative intervention.<sup>8,9</sup>

### **Dental Caries Diagnosis: Radiographic Methods**

Radiographs can be classified into the conventional and advanced techniques. Though, conventional radiographs like bitewing and intraoral periapical radiograph are most frequently used for the detection of caries, they may cause overlapping of teeth due to faulty angulations and may also miss the initial lesion. During the primary dentition, the occlusal surface is most susceptible to caries attack, but with the eruption of first permanent molars the incidence of proximal lesions greatly increases. In such situation, bitewing radiographs are absolutely required to detect proximal lesions in primary molars.<sup>10,11</sup>

The Advanced radiographic techniques include digital radiography and xeroradiography. Digital radiography is a digital, filmless technique for intraoral radiography, utilizes very little of the radiation to which the patient has been exposed and avoids the need for developing films. Xeroradiography has the advantages of producing less

radiation and edge enhancement along with its wide latitude of exposure.<sup>12</sup>

### **Pulp Examination**

Dental pulp tests are investigations that provide valuable diagnostic and treatment planning information to the dental clinician. If pathosis is present, pulp testing combined with information taken from the history, examination, and other investigations such as radiographs leads to the diagnosis of the underlying disease which can usually be reached relatively easily.<sup>13</sup>

### **Pulp Vitality Testing: Assessment of the Pulp's Blood Supply**

Pulp tissue may have an adequate vascular supply, but is not necessarily innervated. Hence, most of the current pulp testing modalities do not directly assess the pulp vascularity and this is exemplified by clinical observations that traumatized teeth can have no response to a stimulus (such as cold) for a period of time following injury.<sup>14</sup>

### **Pulp Sensibility Testing: Assessment of the Pulp's Sensory Response**

Sensibility is defined as the ability to respond to a stimulus, and hence this is an accurate and appropriate term for the typical and common clinical pulp tests such as thermal and electric tests given that they do not detect or measure blood supply to the dental pulp.<sup>15</sup>

### **Pulp Sensitivity: Condition of the Pulp Being Very Responsive to a Stimulus**

Thermal and electric pulp tests are not sensitivity tests although they can be used as sensitivity tests when attempting to diagnose a tooth with pulpitis since such teeth are more responsive than normal.

Clinicians performing pulp sensibility tests use the results, which are essentially qualitative sensory manifestations, to extrapolate and estimate the "vitality" and state of pulp health. If the pulp responds to a stimulus (indicating that there is innervation), then clinicians generally assume that the pulp has a viable blood supply and it is either healthy or inflamed, depending on the nature of the response (with respect to pain, duration, and so forth), the history, and the other findings.<sup>16, 17</sup>

### **Electric pulp tester**

The electric pulp tester (EPT) is widely used to differentiate between lesions of endodontic origin and those not seen on radiographs. This device is designed to deliver an electric current to stimulate the closest myelinated A-delta fibers; the device does not usually stimulate the unmyelinated C fibers because of their higher threshold. The EPT indicates the neural transmission and presence of vital nerve fibers but does not measure the health or integrity of the pulp. Recently traumatized teeth that may temporarily lose their sensory function have no response to the device, even though their vascularity is intact (false-negative) whereas teeth

that are partly necrotic may give a response, even though they lack a blood supply (false-positive).<sup>18</sup>

Location of the electrode was crucial and various responses showed placement of electrode in the incisal one-third, occlusal one-third of the buccal surface and centered between gingival margin and occlusal edge. Recent studies showed placing the electrode more apically and to the center of the supporting cusps showed an increase in the threshold response level. These results were related to the presence of pulp horns, where there is a high concentration of neural elements. EPT remains an important aid and when properly used, it is a safe clinical test that can provide useful information regarding health and disease.<sup>19</sup>

### **APEX LOCATORS IN PRIMARY TEETH**

The endodontic literature deals extensively with location of the apical foramen and determination of the biological apex and working length, as well as with their relationship to the success of endodontic treatment. In addition, pulp and periodontal inflammation may further complicate the anatomy. The working length determination is a critical step during root canal treatment in primary teeth due to possible damage to the permanent successor tooth germ.<sup>18</sup>

The anatomic apex is the tip end or end of root determined morphologically, where as the radiographic apex is the tip or end of root determined radiographically. The apical foramen is the main apical opening of the root canal. In clinical practice, radiography has been the method of choice for determination of working length. However, radiographic assessment has limitations due to anatomic variations of the canal system, interference of adjacent anatomic structures or technical errors in projection. The radiographic method described by Ingle is one of the most common and reliable methods used in determining the working length of teeth undergoing root canal treatment. Radiographic examination in children is usually achieved with difficulty because of the sensor size which cannot be used comfortably in a child's small mouth. Secondly, there is radiation exposure. So a method that could minimize the need for exposing children to radiation during this part of root canal treatment is preferred. All factors together have stimulated the development of electronic root canal measuring devices, also known as electronic apex locators (EALs).<sup>16</sup>

Evolution of different electronic apex locators (EALs) An electronic method for root length was first investigated by Custer (1918). The idea was revisited by Suzuki in 1942 who studied the flow of direct current through the teeth of dogs. He registered consistent values in electrical resistance between an instrument in a root canal and an electrode on the oral mucous membrane and speculated that this would measure the canal length. Sunada took these principles and constructed a simple device that used direct current to measure the canal length. It worked on the principle that the electrical resistance of the mucous membrane and the periodontium registered 6.0 kX in any

part of the periodontium regardless of the person's age or the shape and type of teeth.<sup>16</sup>

### Conclusion

Acceptable accuracy in measuring working length in primary teeth can be achieved by using electronic apex locator. With continuous advancements in the technology of EALs, the correct use of apex locators has a definitive place in clinical Pedodontics and their day to day use in clinics can reduce chairside time, limit radiation and achieve more cooperation from the children.

### References

1. Angmar-Mansson BE, al-Khateeb S, Tranaeus S. Caries Diagnosis. J Dent Educ. 1998 Oct;62(10):771–780.
2. Zero DT. Dental caries process. Dent Clin North Am. 1999 Oct;43(4):635–664.
3. Robeson TM, Heymann HO, Swift EJ. Sturdevant's Art and Science of Operative Dentistry. India: Elsevier Science Health Science Div; 2006. p. 1040.
4. Lussi A, Hibst R, Paulus R. DIAGNOdent: An optical method for caries detection. J Dent Res. 2004;83(Spec No. C):C80–C83.
5. van der Stelt PF. Better Imaging: the advantages of digital radiography. J Am Dent Assoc. 2008 Jun;139(Suppl):7S–13S.
6. Braga M, Nicolau J, Rodrigues CR, Imparato JC, Mendes FM. Laser fluorescence device does not perform well in detection of early caries lesions in primary teeth: An in vitro study. Oral Health Prev Dent. 2008;6(2):165–169.
7. Mendes FM, Siqueira WL, Mazzitelli JF, Pinheiro SL, Bengtson AL. Performance of DIAGNOdent for detection and quantification of smooth-surface caries in primary teeth. J Dent. 2005 Jan;33(1):79–84.
8. Sridhar N, Tandon S, Rao N. A comparative evaluation of DIAGNOdent with visual and radiography for detection of occlusal caries: an in vitro study. Indian J Dent Res. 2009 Jul-Sep;20(3):326–331.
9. Kidd EA, Jayston-Bechal S. Essentials of dental caries: The disease and its management. 1st ed. Bristol: John Wright; 1987. Dec, p. 214.
10. Ashley P. Diagnosis of occlusal caries in primary teeth. Int J Paediatr Dent. 2000 Jun;10(2):166–171.
11. Tyldesley WR, Mumford JM. Dental pain and the histological condition of the pulp. The Dental Practitioner and Dental Record. 1970;20(10):333–336.
12. Dummer PM, Hicks R, Huws D. Clinical signs and symptoms in pulp disease. International Endodontic Journal. 1980;13(1):27–35.
13. Ingle JI. Diagnostic acuity versus negligence. Journal of Endodontics. 2002;28(12):840–841.
14. Seidberg BH, Alibrandi BV. Principles of pulp testing for patients with oral pain. The Endodontic Report. 1987:5–8.
15. Brännström M. The hydrodynamics of the dental tubule and pulp fluid: its significance in relation to dentinal sensitivity. In: Proceedings of the Annual Meeting of the American Institute of Oral Biology, vol. 23; 1966; p. 219.
16. Pierce A. Pulpal injury: pathology, diagnosis and periodontal reactions. Australian Endodontic Journal. 1998;24(2):60–65.

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