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Original Research

Recent innovation in field of pediatric dentistry

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ABSTRACT:
The important goal in pediatric dentistry is to provide best dental care to the child. Pediatric dentistry as a profession has reformed immensely, largely owing to advances in technology, materials, and disease knowledge. Indeed, pedodontics has come a long way from tried-and-tested behavioural management skills to the more tech-savvy virtual reality management. There is plenty to smile about! However, this may be attained with the help of a skilled dental professional and its team. Day by day, science is undergoing great revolutions that are leading the humanity towards a new era of dentistry. Present review article aims give light on the recent innovation in pediatric dentistry.
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INTRODUCTION

Pediatric dentistry provides primary and comprehensive preventive and therapeutic oral health care for infants and children through adolescence, together with special health care needs. This specialty encompasses a variety of skills, disciplines, procedures and techniques that share a common origin with other dental specialties however these have been modified and reformed to the distinctive requirements of infants, children, adolescents and special health care needs.[1] The practice of dentistry experiences a new paradigm shift with the advent and use of new technology. New imaging devices, restorative procedures, internet and powerful electronic devices, laser dentistry and new materials are examples of advances impacting dentistry. Present article aims to in lights the recent innovation in pediatric dentistry.

RECENT INNOVATION IN PAIN MANAGEMENT

Pain control is an important part of dentistry, particularly in the management of children. Behavior guidance, and dose and technique of administration of

the local anesthetic are important considerations in the successful treatment of a pediatric patient.

NEW TECHNIQUES FOR OBTAINING LOCAL ANESTHESIA

1. **Transcutaneous Electrical Nerve Stimulation (TENS):** It is an electroanalgesia and used in simple restorations and periodontal procedures. Two mechanisms have been explained. One is that TENS stimulate the release of the body's endogenous opiates. The other is based on Melzack and Wall's gate control theory.[2] Choudhari SR et al. (2017) compared the efficacy of Transcutaneous electrical nerve stimulation (TENS) and 20% benzocaine gel prior to inferior alveolar nerve block (IANB) injections in alleviating pain in children of 8–12 years of age. Author found application of TENS was more comfortable and significantly reduced pain. TENS is a safe, reliable, and practical alternative to be used in pediatric dentistry.[3]
2. **Buzzy System:** Buzzy is a hand-held device that naturally and quickly minimizes sharp pain from needle sticks like IV starts, blood draws, finger pricks and immunizations, through a combination of vibration, ice and distraction methods. Suohu T et al. (2020) conducted a study to evaluate the pain perception and comfort of patient during local anesthesia (LA) delivery using Buzzy system and conventional syringe and found that the external cold and vibration via Buzzy® can reduce pain and anxiety during local anesthetic delivery for various dental procedures.[4]
3. **Computer - Controlled Local Anesthetic Delivery System:** Many devices have been introduced that can inject local anesthetic into the tissues at a set speed. Collectively, these "painless anesthetic devices", are termed "computer-controlled local anesthetic delivery" (CCLAD) devices. CCLAD also collectively refers to devices that not only slow and maintain the injection speed, but also maintain a constant speed while taking into account the anatomical characteristics of the tissues being injected.
4. **Dentipatch:** A patch that contains 10-20% lidocaine is placed on the dried mucosa for 15 minutes. Shehab LA et al. (2015) effectiveness of the lidocaine Denti-patch ® system versus the lidocaine topical anesthetic gel in children concerning pain reaction during injection and found Denti-patch ® system can significantly reduce the needle injection pain more than the gel.[14]

RECENT INNOVATION IN BEHAVIOUR MANAGEMENT

1. **Virtual reality distraction:** In recent years, there has been an increase in behavioural research in VR and virtual world. By encouraging a patient to focus his or her attention on other thoughts, less attention is available for the pain. Virtual reality utilizes advanced technologies to create virtual environments (VE) that allow patients to be immersed in an interactive, simulated world. These advanced systems interact at many levels with the VE, stimulating sights, sounds, and motion to encourage immersion in the virtual world to enhance distraction from pain. [7] **(Figure no 1)**

Figure no 1: Virtual reality distraction

RECENT INNOVATION IN PEDIATRIC ROTARY ENDODONTICS

Rotary instrumentation has made a quantum leap in the field of endodontics. These changes lead to the introduction of rotary endodontics in pediatric dentistry.[8] Barr et al. was first to demonstrate the use of NiTi rotary files in primary molars advocating the same principles of biomechanical preparation as described for permanent teeth.[9] Many authors have reported the clinical success of Profile, ProTaper, Mtwo, FlexMaster, Light Speed LSX, Hero 642, K3, and WaveOne rotary files in primary teeth. Most recently, Pediatric rotary files has made a major breakthrough in the field of pediatric endodontics.

1. **Kedo System -** Kedo file system is an exclusive pediatric rotary file system introduced by Jeevanandan G et al. in 2016. Kedo nickel-titanium rotary files are patented files exclusively used for root canal preparation of primary teeth. Kedo rotary files have a variable taper designs providing the flexibility and efficiency to achieve consistently successful cleaning and shaping. These files result in significant preparation in the coronal third and sufficient preparation at the middle and apical third of the primary root resulting in an easy flow of the obturating material and avoiding lateral perforation at the apical region.[10,11]
2. **Pro AF baby gold pediatric rotary file -** Pro AF Baby Gold pediatric rotary file (Dentobizz) consist of 5 files made up of NiTi CM wire-Flexible with Constant taper of 4%, 6%.[12]
3. **Pedoflex Rotary Files** – Pedoflex pediatric rotary files are introduced by Neoendo with length 16mm and taper 4%.[13]

RECENT INNOVATION IN SPACE MANAGEMENT

Space maintainers are appliances used to maintain space or regain minor amounts of space lost, so as to guide the unerupted tooth into the proper position in dental arch. After the premature loss of a tooth, not only do space maintainers maintain function and preserve arch length integrity, they also maintain esthetics, prevent encouragement of detrimental habits and eliminate any potential psychological damage, a child could face as a result of the premature loss of teeth. The space maintainer also allows the permanent tooth to erupt unhindered into proper alignment and occlusion.[14]

1. **3D Band and loop space maintainer:** Kids and teens with gag reflexes and special needs can especially find difficult for making impressions for crowns, fillings and other dental restoration. Scanning and 3D printing treatment not only faster but friendly and more comfortable.[15] The use of 3D printing in pediatric dentistry, initially, an ideal mixed dentition cast was poured of a standard dye, for a trial design of 3D printed SM by digital scanning and designing. The cast was scanned using a 3D digital dental scanner followed by the designing of the band and loop similar to the conventional SM, on the Dental CAD 2.2 Valletta. Two types of SMs were printed: (i) using titanium based powdered metal material by Micro Laser Sintering Technology which offers all benefits of an additive manufacturing process and (ii) using a clear photopolymer resin by Formlabs.[16]
2. **EZ space maintainer:** EZ Space Maintainer (Ortho Technology Inc.) is a cost effective, less time-consuming appliance than traditional space maintainers. It requires no impressions, no laboratory construction, and can be directly bonded during one in-office visit. It is more aesthetic, hygienic, simple and easy to use. It provides easy maintenance of the mesio-distal dimension of any lost, deciduous teeth and can be used as an adjustable appliance by using the NiTi coil included to regain some space.[17]

RECENT INNOVATION IN SEMI PERMANENT CROWN

1. **Zirconia pediatric crown:** Prefabricated zirconia crown is a solid ceramic crown that offers better esthetics and is a biocompatible full-coverage restoration for deciduous teeth.[18] EZ-Pedo (EZ-Pedo, Loomis, CA, USA) was the first pediatric zirconia crown commercially accessible in the United States, found by Dr John Hansen and Dr Jeffrey Fisher and initially advertised in 2008.[19] Use of all ceramic restorations has expanded as various different brands (NuSmile ZR Primary Crowns, Houston, TX, USA; Kinder Krowns, St. Louis Park, MN, USA; Hu-Friedy Mfg. Co., LLC, Chicago, IL, USA; and Cheng Crowns, Exton, PA, USA) were additionally made as pediatric zirconia products.[20,21] They are anatomically shaped, metal-free, totally bioinactive, and impervious to decay. [1] **(Figure no 2)**

Figure No 2: NuSmile Trying Crown and Zirconia Crown

(Image courtesy- Dr. Susheel Kumar, Simply Smilez Dental Clinic, Hyderabad)

2. **Golden stainless steel Crown:** Recently, Shinhung Co. Ltd. introduced titanium coated golden Stainless steel crown (Kids crown, Shinghung, Seoul; Korea) which has added advantage over conventional stainless steel crown. They are the SS crown having natural golden luster through titanium coating which provides high quality esthetic finish with easy maneuverability and reduce chair side time.[22] Bamdadian Z et al. (2019) evaluated physical and mechanical properties of different brands of primary molar stainless steel crowns; the results showed that kids has satisfactory physical and mechanical properties.[23] **(Figure no 3)**

Figure No. 3 – Golden stainless steel Crown

(Image courtesy- Dr. Susheel Kumar, Simply Smilez Dental Clinic, Hyderabad)

RECENT INNOVATION IN CARIES EXCAVATION

The most serious problem encountered during caries removal is anxiety, fear and pain. Pressure and heat during mechanical preparation and the annoying noise from the handpiece are to blame. Furthermore, mechanical bur drilling often causes over preparation of sound healthy dentin, leading sometimes to pulp inflammation and even exposure.[24]

1. **Chemomechanical caries removal:** Chemomechanical caries removal is an excellent method for minimally invasive caries excavation, and the removal agents are either sodium hypochlorite (NaOCl) or enzyme-based. The

NaOCl-based agents include GK-101, GK-101E (Caridex) and Carisolv, and the enzyme-based agents include Papacarie and the experimental material, Biosolv.[25] Chemomechanical caries removal (CMCR) is a non-invasive technique eliminating infected dentine via a chemical agent. This is a method of caries removal based on dissolution. Instead of drilling, this method uses a chemical agent assisted by an atraumatic mechanical force to remove soft carious structure. It was introduced to dentistry as an alternative method of caries removal and is mainly indicated to overcome the inconvenience of using burs and local anesthesia, causing less discomfort to patients and preserving healthy dental structure, there by complying the concept of the minimal invasive dentistry (MID).[26]

2. **Polymer bur:** Polymer bur is a unique rotary instrument which is constructed from a medical-grade polyether-ketone-ketone, and it selectively removes decayed dentine without cutting the healthy dentine. This property is based on the hardness of the instrument being lower than the hardness of the healthy dentine. In addition, this minimally invasive excavation has the advantage of fewer dentin tubules being cut and thereby, less pain sensations being triggered compared to using conventional burs.[27] Freedman and Goldstep found that polymer burs remove carious dentin selectively, whereas healthy dentin is not affected. The polymer cutting edges will wear down in contact with harder materials (such as healthy dentin) and will go blunt.[28]

RECENT INNOVATION PEDIATRIC DENTAL SURGERY

In the pediatric dentistry practice, the surgical procedures are related to pain, anesthesia, besides, parent´s anxiety that may influence the children's behavior, making the dental experience negative as well.

1. **Soft tissue laser:** Treating a pediatric patient with laser for oral and dental procedure is beneficial as it is less fearful to the child and better accepted by parents. When clinician uses the laser for surgical or pulpal procedure, children become more cooperative and it also enhances the treatment outcome. It is used for caries prevention, early diagnosis, cavity restoration, management of traumatized teeth, and minor oral surgical procedure in child patients and seems to soon become the gold standard in pediatric dental practice.[29]

A laser-assisted frenectomy can be done with Er: YAG laser in an attempt for diastema closure. Er: YAG laser is also used for surgical management of severe tongue tie or ankyloglossia in infants and children.[30,31] CO_2 laser is used for gingivectomy procedure. It is also used for surgical removal of soft-tissue tumor in the oral cavity. With the advent of diode laser, nowadays, clinicians prefer to reproduce gingival esthetics as a part of comprehensive orthodontic treatment. The advantage of using the laser in gingivectomy and gingival recontouring is that it provides a bloodless field and also sterilizes the wound by reducing the microbial load exposed to laser radiation.[29,32,33]

CONCLUSION

Pediatric dentistry provides primary and comprehensive preventive and therapeutic oral health care for infants and children through adolescence, together with special health care needs. Many new developments have occurred in pediatric dentistry in recent years. Along with the development of newer material and technology the Pedodontist has a wide array of treatment modality available for treating pediatric patients. Thus, learning of new technology and incorporation in routine practise has become mandatory for pediatric dentist in present era.

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