PART 3

ILLUSTRATED PEDIATRIC DENTISTRY

Editors:
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Ritesh Kalaskar
Dhanashree Sakhare

Bentham Books

Illustrated Pediatric Dentistry (Part 3)

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FOREWORD 1

It is my great pleasure to pen down a foreword for this tremendous book on Pediatric Dentistry for a legend and doyen of the subject, a mentor and guide to the brightest of minds in the field of dentistry.

Rising from the fundamentals, comprehensive in-built, contemporary and authoritative in construct and approach, and hands-on to the core, ***Illustrated Pediatric Dentistry*** is a wonderful work engineered by some of the best-known academics in this noble realm. The chief author, ***Professor Satyawan Damle***, is a colossus among giants, having been a celebrated teacher, distinguished leader, and dynamic policymaker at several dental institutions and universities, including the most prized, the University of Mumbai.

Prof. Satyawan Damle is the rare blend of a gifted clinician and a carved-out academic guru whose intellect has emerged with decades of practice. It is no secret that the degree of acquisition of knowledge by students is one of the measures of the effectiveness of a medical curriculum; and with Pediatric Dentistry being one of the crucial epicentres of growth, it has the potential to make momentous advancements in the evolutionary trajectory of oral and general health.

His co-editors ***Ritesh Kalaskar***, and ***Dhanashree Sakhare*** are examples excellence in their arena. The work reflects their collective understanding of where pediatric dentistry stands today, what have been the treasures and well-kept secrets of the past, and where this tree of knowledge finds fruition today pawing way for the future.

Embedding best care practices of all times, ***Illustrated Pediatric Dentistry*** is a comprehensive yet concise work, which fulfills the essentials of the pediatric dentistry curriculum both for graduates and postgraduates across all universities.

Walking you through the nitty-gritties of preventive, curative and restorative childhood dentistry, be it the behavioral challenges, cariology, endodontics, traumatology, para-surgical themes such as the use of conscious sedation and general anaesthesia at that age, and the management of medically compromised children, the work is a tree of knowledge, nurtured with experiential learning, and carries wonderful blossoms of practical wisdom.

Let us savour and celebrate the chef-d'oeuvre. Indeed, ***Illustrated Pediatric Dentistry*** is a must-read and must-assimilate work for each one of us. Students, practitioners and teachers of Pediatric dentistry will cherish it as a treasured possession on their shelves. I congratulate Prof. Damle and Bentham Science, Singapore, for publishing this irreplaceable tome.

Prof. (Dr.) Mahesh Verma
Vice Chancellor
Guru Gobind Singh
Indraprastha University,
New Delhi,
India

FOREWORD 2

I am delighted to write this foreword for a Book of Illustrated Pediatric Dentistry authored by Professor Satyawan Damle and other academicians. Prof. Satyawan Damle is a well-known researcher and academician with over 44 years of clinical and teaching experience in Dentistry. Besides the several posts and hats he wore in the various roles he played for the profession, he is also a recipient of several awards and recognitions, including the Lifetime Achievement Awards, Outstanding Public Servant Awards, and Research Awards and Fellowships. He is an active member of the Indian Council of Medical Research. Despite his extraordinary achievements as a Pediatric dentist, researcher, and academician, Prof Satyawan Damle will always be known as the longest-serving chief editor of Indexed journals. For almost 35 years. He dedicated himself to overseeing the publication of the highest-quality peer-reviewed studies and opinion pieces on child dental health.

Prof. Damle is actively involved in writing several books on Pediatric Dentistry and Dentistry, which is the testimony of his in-depth knowledge of the subject. The Book of Illustrated Pediatric Dentistry is their new venture initiated by him. I am confident that this book will be accepted by students and faculty involved in teaching Pediatric Dentistry. His work as a teacher, researcher, innovator, visionary and extraordinary academician made him a legend. His role as a mentor and friend made him a role model to those of us who know him and worked with him. His legacy persists not only in academics but also as an able administrator, as he proved his mettle as the Dean of a dental school, Director of Medical Education, Joint Municipal.

Commissioner of Mumbai and, ultimately, the Vice Chancellor of a University. Prof. Damle has worked conscientiously and untiringly to present an unmatched educational endeavour. The topics in this book display clear and succinct clinical expertise and the capability of imparting updated education and information to Oral Health Professionals. The entire volume of this book deals with ultramodern and current state-of-the-art techniques. I take this opportunity to congratulate Prof. Satyawan Damle and his team of contributors - Ritesh Kalaskar and Dhanashree Sakhare for having published this Textbook for Bentham Sciences.

Dr. Ashok Dhoble
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PREFACE

It is imperative to have an established approach to handling Children's oral diseases. **'Illustrated Pediatric Dentistry'** is an unpretentious endeavour to integrate the latest developments and up-to-date reviews in the field of Pediatric dentistry by distinguished writers. The book intends to allow students to understand the conceptions of Pediatric dentistry and create a spur to discover the subject by advance reading. Several illustrations, descriptions and graphic drawings have been included to attract the students and make the subject simple to comprehend. A healthy mouth is a gateway to a healthy body and the best time to inculcate healthy habits is through childhood. Prevention of the initiation of oral diseases and training appropriate oral hygiene methods are commenced best throughout the formative years of the child. With a substantial percentage of the worldwide population being in the Pediatric age group, it is imperious to have a scientific approach to behaviour management, prevention and treatment modalities in the dental office, as Pediatric dentistry is a fast-growing division of dental disciplines that lays the basis for the impending dental health of the populace.

The book has been divided into several sections. The sections on child psychology and the emotional development of children are important to learn the basics of various behaviour management strategies. The section on dental caries sensitizes the reader towards the most common dental disorder that is seen in children, and preventive procedures aimed towards lessening dental caries are the necessity of the hour. While an endeavour has been made to include the growth and development of the facial structures and dentition and along with their disturbances and the interceptive and preventive procedures to monitor the erupting teeth.

Pediatric Operative techniques, including endodontics and management of teeth with immature apices affected due to Dental caries and traumatic injuries have been given prominence. Innovations in the field of Pediatric Dentistry are transpiring amazingly fast, and it is crucial to stay up to date with the latest materials, equipment and techniques to deliver the highest quality of care to our little patients.

The New Book cannot be successfully compiled without the collective contribution regarding meticulous reviews of the manuscript to keep pace with the latest innovative novelties. The credit for introducing a New Textbook goes to the contributors for their engrossment, devotion and dedication in presenting a manuscript after applying prudent and well-adjudged scrutiny and analytical approach and have excelled in exploring things to the ultimate.

Accumulation of information and its cogent management would not have been conceivable without the efforts of the contributors who have painstakingly submitted their manuscripts to shape this gargantuan task and introduce this book in the service of Pediatric dentistry.

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ACKNOWLEDGEMENTS

We do not find such appropriate words to praise the unique nature of Dr. Mahesh Verma, Vice Chancellor of Guru Gobind Singh Indraprastha University, New Delhi, who himself being a great resolute and connoisseur of dentistry occupying an illustrious position with an eminent background in dentistry, has spared his valuable time from his busy schedule to inscribe the foreword for the Textbook of" Illustrated Pediatric Dentistry." We take it as inventiveness and encouragement rather than a morale-boosting for us to uphold and keep up our determination to satisfy our hunger for academics for the advantage of budding dental professionals.

We also do not find such befitting words to laud the unique nature of Dr. Ashok Dhoble Hon, General Secretary Indian, Dental Association Head Office, who himself is a great advocate and connoisseur of dentistry occupying a distinguished position with an illustrious background in dentistry has spared his precious time from his busy schedule to write the foreword for the Textbook of Illustrated Pediatric Dentistry. I take it as an inspiration and encouragement rather than a morale-boosting for us to uphold and keep up our determination to satisfy our hunger for academics for the advantage of budding dental professionals.

We are also indebted and beholden to the contributors for their altruistic and substantial contribution to make this Textbook of Illustrated Pediatric Dentistry, a great academic endeavour. The contributors are highly competent and knowledgeable clinicians known for their aptitude and capability, which have successfully recognized the most complex and convoluted details of each topic, duly integrating and blending the latest advancements and innovations in Pediatric Dentistry. They are a terrific hard worker and legendary luminaries known for their admirable accomplishments and remarkable involvement in dental education. They have made lots of efforts to lead things to excellence. Credit goes to these patrons and benefactors for the benevolent bequest of their vast knowledge and experience for the betterment of dental education.

We would also like to thank Dr. Priyanka Bhaje, Dr. Parag Kasar, Dr. Sharath Chandra, Dr. Prachi Goyal and Dr. Vidya Iyer for their painstaking efforts and intransigent toil during the editing of this book. They displayed exceptional patients, forbearance, and commitment during the preparation of the book Our dream has come true due to the support of our past and present students. Credit also goes to our family members for their tolerance, Love, and affection.

We would like to appreciate the efforts of Mrs. Humaira Hashmi & Mrs. Fariya Zulfiqar of Bentham Science for giving us an opportunity to pen down our ideas and academic work into reality. We also convey our kind and sincere appreciation to Pascali Pascalis.

Representative of Porter Instrument Business Unit of Parker Hannifin Matrx by Parker and Parker-Porter Product for permitting us to use the company products in our book.

Lastly, we would like to state that fortune favours those who defy complexities and overcome them on their own. We also passionately believe that Man is the architect of his own destiny, and God is on the side of those who toil and perspire to make their providence.

We place our sincerest admiration and gratitude to all those who have delightfully contributed to this cause and for their wishes and devotions made for understanding our dream.

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CHAPTER 1

Crown in Pediatric Dentistry

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Abstract: The basis for safe permanent teeth in infants and teens is laid during the first years of childhood. Several studies have linked dental caries in children to insufficient diet, unhealthy eating habits, and insufficient toothbrushing habits during the first two years of childhood. The emergence of caries in primary teeth increases the chance of developing caries in permanent teeth. Once a tooth has decayed in young children, the paediatric dentist plays a crucial role to return the tooth to its full functioning potential. The technical advancements in dental products utilized in children over the last few decades are a necessary prerequisite because what was acceptable in the past is not necessarily the safest way to treat young patients nowadays. Several alternatives exist to restore carious teeth in paediatric patients, ranging from stainless steel crowns to aesthetic crowns such as strip crowns and zirconium crowns, which are gaining popularity. This chapter contains a description of the crowns in paediatric dentistry.

Keywords: Stainless steel crowns, Open-faced stainless-steel crown, Polycarbonate, Strip crowns, Pedo jacket, new millennium, Cheng crowns, Kinder crowns, Nu-smile, Dura- crown, Pedo pearls, Zirconia crowns.

INTRODUCTION

Oral wellbeing is a mirror of a person's lifestyle. Dental caries is now one of the most common multifactorial diseases on the planet. In infants, carious lesions begin with the destruction of tooth surface, which may influence aesthetics, self-esteem, mastication, speech, arch length maintenance, and the creation of oral habits, causing disorientation of overall health. So, it is essential to restore the deciduous carious teeth depending on their location, forces delivered to the tooth with various forms of crowns to maintain dental integrity before permanent teeth emerge.

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The crowns are available into 2 categories [1]

1] Preformed crown and luting cement used for cementation

e.g. Stainless steel with facing, Cheng crowns, Kinder crowns, Nu-smile, Dura-crowns, Whiter bite, Pedo pearls

2] Crown which is bonded to the tooth

e.g. Polycarbonate, Strip crowns, Pedo jacket, new millennium

Stainless steel crown - The Preformed Metal Crown (PMC) most commonly known as the Stainless-steel crown (SSC). It is introduced by Humphrey in 1950 [2]. Stainless steel crown is most commonly used in deciduous dentition than permanent dentition (Tables **1** and **2**).

Classification of Stainless-Steel Crown

Based on Composition

1] Stainless Steel crown (18-8) austenitic type: - 17-19% Chromium, 10-13% Nickel, 67% Iron, 4% Minor elements *e.g*.- Unitek and Rocky Mountain crowns

2] Nickel-Base crowns: -72% Nickel, 14% Chromium, 6-10% Iron, 0.004% Carbon, 0.35% Manganese, 0.2 Silicon *e.g*.- Ion Ni-chro from 3M

3] Tin Based crown

4] Aluminium Based crown

Based on Morphology

1] Uncontoured/ untrimmed crowns – This neither trimmed nor contoured and required lots of adaptation (Fig. **1a**). They are longer in size, and it is time consuming. *e.g*. Unitek and Rocky Mountain crowns.

2] Pretrimmed crowns – It is straight and having non-contoured sides (Fig. **1b**). This crown requires lots of contouring and trimming. It is festooned to follow gingival crest. *e.g*. 3M and Denovo crowns.

3] Precontoured crowns - This crown is festooned and having pre-contoured and pre-trimmed (Fig. **1c**). Manufactures gingival crimp loss due trimming may cause difficulty in adaptation. *e.g*. Ni-chrome crowns and Unitek stainless steel crowns.

Table 1. Indications and contraindications of crowns (Fig. 2).

Indications	Contraindications
1.Extensive decay of primary teeth – when tooth decay includes two or more than two surfaces. 2. Following pulp therapy procedures- Pulp therapy makes tooth brittle and to prevent brittleness or fracture of tooth. 3. As a prevention restoration – Used in high caries index patient 4. Restoration of primary molars affected by localized or generalized developmental problems eg. – Hypoplastic defect 5. Used in a space maintainer or denture 6. Severe bruxism- In this condition tooth surfaces chip off and may cause pulpal exposure. So, to prevent this stainless-steel crown is used.	1. Allergy and sensitivity to nickel 2. Tooth with radicular pathology 3. Physiological tooth mobility or Tooth near to exfoliation 4. Slightly erupted tooth

Table 2. Advantages and Disadvantages of crowns.

Advantages	Disadvantages
1. Their life expectancy is the same as that of a healthy tooth. 2.They give stability to the tooth that may have become brittle after excessive caries removal. 3.The technique sensitivity or the risk of making errors during their application is low. 4. Their long-term cost effectiveness is good. 5. Low clinical failure rate.	1.It looks like metal. 2.It cannot be used when the tooth is slightly erupted.

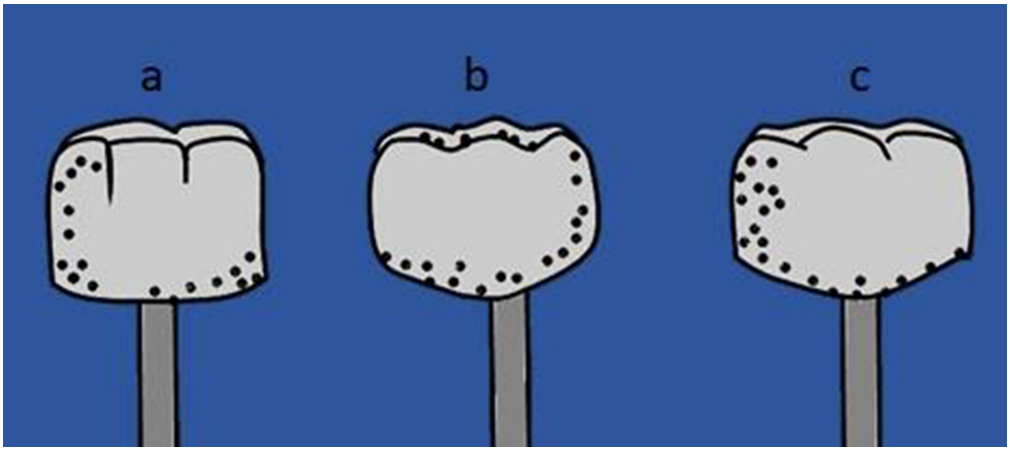

Fig. (1). Types of crowns.
a - Untrimmed crowns b - Pretrimmed crowns c - Precontoured crowns.

CHAPTER 2

Prosthetic Management in Pediatric Dentistry

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[2] *Founder, Lavanika Dental Academy, Melbourne, Australia*

Abstract: Prosthetic management is the healing part of the dentistry which plays a crucial role in rehabilitating the missing or damaged oral and maxillofacial structures. Dental aesthetics is a paramount important aspect in today's society and is faced by many challenges like age, periodontal condition, occlusal adjustments, patient's cooperation *etc*., to overcome this the dentist should have a thorough knowledge regarding prothesis before the fabrication and delivery. In this chapter, various prosthesis like removable partial denture, fixed partial denture, complete denture, implants, maxillofacial prostheses their types, advantages, disadvantages, indications, contraindications, fabrication *etc*., have been discussed in detail which will help in successfully understanding and treating the patient to obtain positive treatment outcome.

Keywords: Prosthetic Management, Removable Partial Denture, Fixed Partial Denture, Complete Denture, Implants, Maxillofacial Prosthesis.

INTRODUCTION

While treating children whose dentition fails to develop normally prosthetic treatment plays a crucial role. Prosthetic replacement for young children is frequently indicated in the existence of congenitally absent teeth in cases like cleft palate, ectodermal dysplasia *etc*., A prosthetic rehabilitation offers a functional and aesthetic outcome that will allow the child a scenario close to normal lifestyle, without destroying the self-esteem or psychological development [1] (Table **1**).

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Table 1. Sequelae of missing primary teeth.

Missing primary incisors or molars results in deleterious oral habits that might cause forward or lateral tongue thrusting, respectively.
Early loss can cause resorption of the alveolar ridge, tooth migration, and impaired occlusion, which eventually effect the mastication, speech, and aesthetics.
Immature loss of tooth could lead to disproportionate growth of orofacial structures.
Congenitally missing anterior teeth or missing teeth due to trauma may cause psychological disturbance in children [3].

Terminology

A prosthesis is an artificial replacement of part of the human anatomy restoring form, function, and esthetics (GPT-9) [2].

Dental prosthesis is an artificial replacement (prosthesis) of one or more teeth (up to the entire dentition in either arch) or associated dental/alveolar structures (GPT-9) [2].

Important Considerations During Prosthetic Treatment in Children

Proper diagnosis and treatment strategy are important before starting any dental procedures on pediatric patients. It involves thorough history, intraoral examination, extraoral examination and radiographic examination.

Prosthetic Treatment Option in Children

Based on the defect type, various methods of prosthetic management can be planned.

1. Removable prosthesis
    a. Complete denture
    b. Partial denture
    c. Overdenture
    d. Immediate denture
2. Fixed partial denture
    a. Conventional fixed partial denture
    b. Resin bonded fixed partial denture
3. Implant prosthesis
4. Maxillofacial prosthesis

Removable Partial Dentures (RPD)

Removable partial denture is a removable denture that replaces some teeth in a partially edentulous arch; the removable partial denture can be readily inserted and removed from the mouth by the patient (GPT-9) [2], Fig. (**1**).

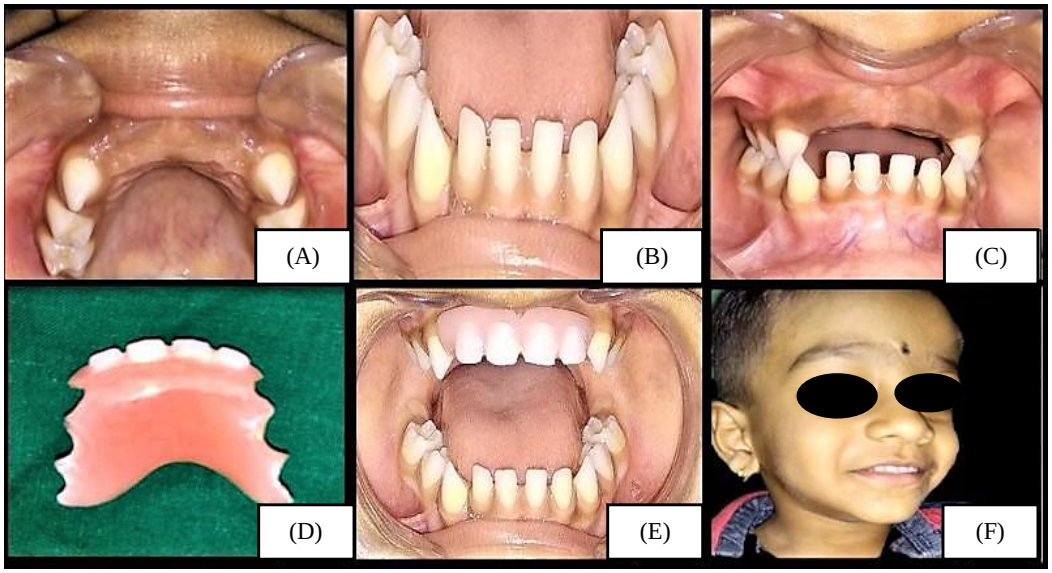

Fig. (1). Removable partial denture **(A – F)**: A –Intraoral image showing missing anterior in maxillary arch, **B** – Mandibular arch, **C** Intraoral view showing occlusion, **D** RPD for maxillary anterior teeth, **E** RPD in place, **F** Post insertion extraoral image of child.

Indications and contraindications of RPD are enumerated in Table **2**.

Table 2. Indications and contraindications of RPD.

Indications	Contraindications
Premature loss of primary molars, requiring space maintenance.	When FPD can be planned.
Radiographic evaluation confirms that the time period between the primary teeth lost and the eruption of succedaneous teeth is greater than six months.	In substituting a smaller number of anterior teeth where aesthetics is a main concern.
Removable partial dentures are frequently indicated in children who have lost their teeth as a sequalae of trauma.	Disabled patients who cannot maintain RPD.
Congenital conditions requiring prosthesis. E.g., partial anodontia in ectodermal dysplasia.	In children with uncooperative behaviour.
Compromised periodontal support of remaining teeth.	-
To obtain cross arch stabilization.	-

CHAPTER 3

Diseases of Pulp and Periradicular Tissues

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Abstract: The Dental pulp has remained a diagnostic enigma to the dental surgeon. While some dental pulps would react inadvertently even to the slightest injury, at other times highly resistant pulp tissue has regenerative properties even after extensive damage has been noted. However, most of the time clinicians can make a uniform decision about the status of the dental pulp with the help of clinical signs and symptoms and make a patient-centric treatment plan that can provide pain relief and restore the form and function of the tooth. A distinction needs to be made between acute and chronic inflammatory conditions of the pulp and between the reversibility or irreversibility of the pulpal changes so that appropriate vital or non-vital pulp therapies can be selected.

It is also important to distinguish between inflammatory conditions and degenerative conditions of the pulp. While inflammation almost always requires intervention, changes like degenerative calcific changes may require observation and occasional intervention.

Keywords: Degenerative Pulpal Disease, Pulp Diseases, Pulp Inflammation.

INTRODUCTION

The dental pulp is sensitive to external factors such as microbial infection from dental caries and or mechanical/chemical irritations during dental procedures. Dental tissue behaves differently than other connective tissues. It is unique in the way that its soft tissues which are the pulp and pulp-dentin complex are enclosed within mineralized hard tissues of the tooth namely enamel, dentin, and cementum, and are supplied by a rich neurovascular network that regulates various inflammatory mediators. Inflammatory signals may progress to rapid

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degeneration and necrosis, and such events could inflict serious damage to tissues in the body. One of the sequelae of dental caries is inflammation of pulp and pulpal diseases when the carious lesion involves the pulpal tissue.

Causes of Pulp Disease

Following are the common etiological factors for pulp pathology. Many classifications of etiologies have been proposed by a couple of authors. The classification of etiology of pulpal diseases has been given as follows:

1. Physical damage
    a. Mechanical
        i. Trauma
            1. Trauma from dental and non-dental origin
            2. Rapid orthodontic movements
            3. Iatrogenic pulp exposure during cavity preparation
            4. Abfraction
            5. Crack Tooth Syndrome
        ii. Pathologic wear
            1. Attrition
            2. Abrasion
            3. Bruxism (Fig. **1**)
        iii. Barometric changes: Barodontalgia
        iv. Radiation
    b. Thermal
        i. Heat due to cavity preparation
        ii. Inadequate or no use of coolants
        iii. Exothermic heat from the setting of restorative materials
        iv. Finishing and polishing of restorations
        v. Inadequate or absence of base under restoration
    c. Electrical: Galvanism due to dissimilar metals
2. Chemical
    a. Leaching of harmful products from restorative materials
    b. Erosion of teeth
3. Bacterial
    a. Direct invasion of pulp by bacteria due to caries or trauma
    b. Bacterial toxins
    c. Anachoresis
        i. Retrograde bacterial invasion
        ii. Perio-endo lesions
4. Developmental disorders of teeth

a. Dens invaginatus
b. Dens evaginatus
c. Dentinogenisis imperfecta
d. Amelogenesis imperfecta
e. Molar Incisor Hypoplasia

5. Iatrogenic
   a. Intentional extirpation of pulp
   b. Electrosurgery
   c. Laser burn
   d. Surgical techniques
      i. Intubation during general anaesthesia
      ii. Enucleation of cysts and tumours
      iii. Placement of Osseo plating screws
      iv. Osteotomies

Classification of Pulpal diseases

Many different classification systems have been proposed for pulp diseases, although most of them are based on histopathological findings. Many authors and clinicians have attempted to correlate the histological conditions of the pulp to the clinical signs and symptoms [3]. A clinician's ability to diagnose accurately is dependent on having a thorough understanding of the disease processes involved as well as the diagnostic procedures and tests being used and their limitations.

Grossmann's Classification [1, 2]

1. Pulpits [inflammatory diseases]

a. Reversible

i. Acute Symptomatic

ii. Chronic asymptomatic

b. Irreversible

i. Acute

• Abnormally responsive to cold

• Abnormally responsive to heat.

ii. Chronic

• Asymptomatic with pulp exposure

CHAPTER 4

Diagnoses of Pulp Pathoses in Children and Investigations

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Abstract: A correct finding of the ailment of the pulp in teeth conceded by caries, dental processes or other forms of injury is vital for arriving at a proper conclusion for the treatment. Essential evidence in this respect is whether the pulp is vital or necrotic. It is similarly important to be able to ascertain whether the pulp is reversibly or irreversibly inflamed, mainly in connection with a carious or traumatic exposure of the tissue. In other words, can the pulp heal and continue in a long□term perception or is it scratched to the extent that it is not curable, and is a root canal treatment required? Diagnostic information is gained from the patient's history of pain or irritation, the experience of trauma or restorative techniques, clinical examinations, results of clinical tests and radiographic assessment of the teeth and the surrounding tissues. A diagnosis is rarely based on a single finding, but rather on a set of reflections. The clinical condition may be so complex that a proper diagnosis and treatment outcome requires a diagnostic process comprising several steps

Keywords: Clinical, History, Pathosis, Pulp, Radiograph.

INTRODUCTION

The chief complaint is generally the first information to be obtained. It is expressed in the patient's own words describing the condition that prompted him or her to seek treatment. The chief complaint is recorded in non-technical language. The children are sometimes able to tell and describe the condition but there are times when the chief complaint has to be obtained from the parent or an accompanying person when the child is very young and unable to describe the complaint or in a medically and physically challenged child.

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Correct treatment begins with a correct diagnosis. Arriving at an accurate diagnosis requires knowledge, skills, and art; the knowledge of identifying the diseases from their signs and symptoms, skills to apply proper test procedures, the art of synthesizing impressions, facts, and experience into understanding. To arrive at an accurate diagnosis of pulp status, histological evaluation is practically impossible therefore clinicians should co-relate history, examination, and diagnostic tests together.

Misdiagnosis implies the inability to derive the correct diagnosis with resultant incorrect treatment and mistrust between the patient and dentist. To avoid misdiagnosis and to rule out orofacial pain of non-pulpal or peri-radicular origin, a step-by-step systematic approach to diagnosis and treatment planning must be followed.

Symptoms and signs of pulpal diseases are snippets of information that allow the clinician to paint an entire picture of the pulpal condition. Symptoms refer to the information that the patient or their relatives can relay and explain to the health worker while signs are elicited by the operating dental surgeon to help in diagnosing the disease.

HISTORY AND RECORD

To avoid irrelevant information and to prevent errors of omission and clinical tests, the clinician must practice a fixed routine for examination protocol. Thus, the criteria for an accurate clinical diagnosis are that the clinician should include a good case history, a thorough clinical examination, relevant investigations, or diagnostic tests.

Demographic Data

The demographic data includes the name, age, and gender of the patient. Education level, socioeconomic status, address, contact number, religion, birth date, and registration details like case paper number should also be included. In the case of children, additional details like the nickname, name of the school, friends and teachers should also be recorded to help in initiating conversations with the child and make the child more comfortable. Whenever possible, the child's hobbies, favorite cartoons, TV shows, likes and interests should also be recorded to maintain a fluent conversation during the child's visits.

Medical History

Detailed comprehensive medical history is an absolute necessity before the commencement of any dental treatment. Any present or previous medical history

the clinician can determine, whether medical consultation or premedication, is required before diagnostic examination or clinical treatment is undertaken. The dentist should be aware of the maledictions that the patient is following to avoid any adverse drug reaction and to understand the patient's susceptibility and reaction to infection and bleeding. This will help in understating the patient's susceptibility and reactions to infection and bleeding.

Dental History

Understating the patient's attitudes toward oral health, care and treatment can be assessed by recording the dental history. Dental history reveals past dental experience and clues to the patient's psychological makeup as well as explains subtle clinical findings.

Clinical Diagnostic Examination

In the diagnosis of pulpal pathology, the clinical diagnostic method includes a subjective and objective examination. Subjective symptoms are those explained by the patient himself or herself.

Pain [1]

One of the first main complaints from the patient is pain and it must be recorded carefully as it plays an important role in diagnosing pulpal or peri radicular pathology. Intensity, spontaneity, and persistent nature of pain are strongly indicative of pulpal and/or peri radicular pathosis. The pain of high intensity is usually intermittent, whereas low-intensity pain is often continuous and protracted. Spontaneous pain occurs without an eliciting stimulus. It awakens the patient or begins without stimulus; it is spontaneously combined with intense pain usually indicating severe pulpal and/or peri radicular pathosis. Persistent type of pain is of a lingering type that continues evenly and increases in intensity after the stimulus is removed. Pain can be of non-dental origin, periodontal origin, or dental origin.

Non-dental pain is of systemic conditions like trigeminal neuralgia, acoustic neuroma, herpes zoster, diabetic odontalgia and myocardial infarction, which present infrequently in the dental office. However, the pain of atypical facial neuralgia is most frequently referred by physicians to dentists for consultation and creates a diagnostic problem when deep fillings are present. Periodontal pain is usually due to periodontal disease. There can be a rather large amount of bone loss without any pain as pus can usually drain out of a periodontal pocket so press

CHAPTER 5

Pediatric Endodontics

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Abstract: Pediatric endodontics is an integral part of dental practice that aims to preserve fully-functional primary teeth in the dental arch. Despite advances in the prevention of dental caries in pediatric dentistry, the occurrence of pulpal-involved primary teeth and their premature loss continue to be a common problem. The benefits of preserving primary teeth are of utmost importance. Primary teeth aid in mastication, phonation, and guidance of permanent tooth bud, harmonized temporal and spatial development of permanent teeth and prevent the detrimental psychological effects due to tooth loss. Despite the emphasis, prevention in primary teeth remains much talked about and rarely practiced. Restoration of a child's dentition to a healthy, functional status is often complicated by the severity of dental caries, particularly in the primary dentition, which often falls prey to the ravages of decay. Moreover, primary dentition is often regarded as transient and hence, undeserving of much time or effort. The intervention is only sorted when the child experiences pain due to the decay. Unfortunately, the delay incurred due to dental caries renders the tooth non-restorable.

Keywords: Pediatric Endodontics, Root Canal Treatment, Pulpectomy, Pulpotomy, Technique.

INTRODUCTION

Primary teeth should be preserved until their normal exfoliation time to maintain arch length and function to provide proper guidance for the eruption of permanent teeth, enhance aesthetics and mastication, prevent aberrant tongue habits, aid in speech, and prevent the psychological effects associated with the tooth. Paediatric dentistry is a unique speciality that deals with the total oral health care of children. Anciently, Pediatric dentistry has evolved from an extraction-oriented practice, where primary teeth with inflamed pulps were mostly extracted and did not focus on preserving the pulp, to a speciality based on emphasizing the prevention of oral

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and dental diseases where extraction of teeth with symptomatic pulpits becomes obsolete [1]. The aim of pulp therapy in the primary dentition is to retain the primary tooth as a fully functional part of the dentition, problems related to the loss of teeth. Clinically, the choice of pulp therapy is based on interpretation despite the assessment difficulties and imprecision of pulp tests related to the primary dentition.

The choice of treatment modalities in primary teeth is generally based on the severity of the symptoms clinically and/or radiographically. When indicated, pulp capping or pulpotomy of the deciduous tooth is relatively an easy procedure with generally good clinical results. Pulpectomy on the other hand is a heavier treatment for the child and is more complicated due to anatomical complexities that are not found in the permanent tooth.

A review of the anatomy of primary teeth readily explains the frequent need for pulp therapy to maintain the integrity and health of oral tissues (Fig. **1**).

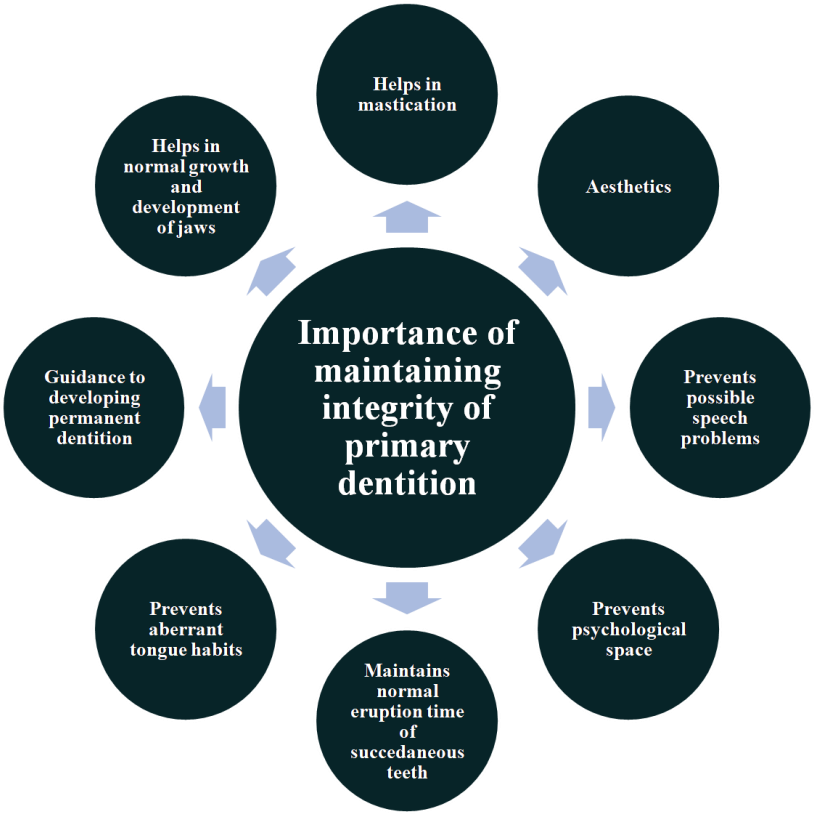

Fig. (1). Importance of Primary Teeth.

Ideally, Finn [1] and Ash [2] described basic differences between primary and permanent teeth that can be summarized as follows:

The enamel of primary teeth is thinner than on permanent teeth. Also, the thickness of the dentin between the pulp chambers and the enamel in primary teeth is comparably less than that of permanent teeth. The pulp horn in primary teeth is closer to the dentin-enamel junction, and dental caries can progress into the dentin more rapidly, leaving the tooth more susceptible to infection. Thus, pulp exposures caused by caries occur more frequently in deciduous teeth. If the infection spreads to the alveolar bone, then there are chances that the succedaneous teeth may also be affected.

Historical Perspective

At the beginning of the twentieth century, it became obvious that microorganisms were the reason for pulp inflammation, and more attention was drawn to disinfecting agents that, although effective, were very cytotoxic. The first method of pulp capping was described by ***Phillip Pfaff*****,** a dentist at the court of the Prussian King **Friedrich II in Berlin** in **1756** who used gold foils [3]. Various agents for direct pulp capping had been recommended ever since. The first scientific clinical study to correlate the different pulp capping materials was conducted by ***Dätwyler*** in **1921**, where zinc oxide-eugenol showed the best results. ***Hermann*** (1920) introduced calcium hydroxide as a root canal filling material [3]. Between 1928 and 1930, ***Hermann*** studied the action of calcium hydroxide on vital pulp tissue and prove that it was a biocompatible material [3].

There has been a paradigm shift in the approach regarding reversibly inflamed pulp from an **"aggressive"** approach involving total excavation of the carious dentin increasing the danger of exposing the pulp, towards a more **"conservative"** approach in which dental caries may be left in the pulpal wall to prevent pulpal exposure. This approach is being slowly spread among dental professionals and may become the treatment of choice for deep caries in modern paediatric dental practice. If minimally invasive dentistry is reluctantly accepted by the professional community, teeth with reversible pulp inflammation, that could otherwise be conservatively treated, will become pulpally infected.

The Primary Pulp

1. The dental pulp is considered a specialized connective tissue of mesenchymal origin surrounded by tubular dentin walls occupying the pulp chamber and the root canal. The specific cells present in dental pulp known as Odontoblasts are responsible for the synthesis and deposition of the collagen-rich dentin organic matrix which will be further mineralised to the pulp tissue. So, the dentin and

CHAPTER 6

Management of Young Permanent Teeth (Apexogenesis, Apexification and Regenerative Endodontics)

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Abstract: Traumatic injuries suffered by the anterior teeth mostly occur before completion of the root formation which may have consequences like inflammation or necrosis of the pulp. The most sensitive part of a young permanent tooth to trauma is the Hertwig's epithelial root sheath (HERS). However, root formation can still continue to occur if there is a disruption of vascularity and cellularity in the apical region, even in the presence of pulpal inflammation and necrosis of the traumatized teeth. Hence, every effort should be made to maintain the viability of HERS as it acts as a source of undifferentiated cells which could give rise to the formation of the hard tissue and it also protects the tooth against the ingrowth of the cells of periodontal ligament into the root canal, which might result in intracanal bone formation and cessation of root development. In cases where complete destruction of Hertwig's epithelial root sheath occurs, the development of a normal root comes to a halt but, this does not mean that there is an end to the deposition of hard tissue in the region of the root apex. Although, once the sheath has been destroyed, there can be no further differentiation of odontoblasts but, the hard tissue can still be formed by cementoblasts which are present in the apical region or by fibroblasts of the dental follicle and periodontal ligament cells that undergo differentiation after the injury. This chapter is specifically oriented towards discussion of the viable methodology and treatment modalities of vital, nonvital immature young permanent teeth.

Keywords: Apexification, Apexogenesis, $Ca(OH)_2$, Immature teeth, Pulp, Vital/Non-vital teeth.

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INTRODUCTION

The formation of dentin is among one of the main functions of the dental pulp. Whenever the pulp undergoes a pathological change before the complete development of the root, its growth gets disrupted. In cases like caries or an exposure where a pulp is reversibly inflamed, the treatment of choice is to maintain pulp vitality by pulp capping or pulpotomy. However, if the pulp irreversibly inflamed or necrotic, apexification is the treatment of choice. The traditional apexification procedure consisted of multiple and long-term application of calcium hydroxide for creation of an apical barrier which would aid in the obturation of the root canal. Currently, the apexification procedure involves the use of mineral trioxide aggregate (MTA) for the formation of an apical barrier against which a three-dimensional obturation can be done. In addition to this, the novel procedures like pulp regeneration have received an immense attention as an option for such teeth.

Major Causes of Pulpal Diseases

1. Microbiota

2. Iatrogenic injury caused by trauma

3. Dental procedure generating thermal stimulation

4. Chemical agents

The pulp tissue can be affected by dental traumatic injuries and restorative procedures. The thermal irritation can occur during tooth preparation or finishing procedures, dry cutting, using dull burs, deep periodontal curettage, orthodontic movement. Also, the heat generated from the polymerization shrinkage of resin materials or lasers and air abrasion devices can cause an injury to the associated tooth pulp. The chemical irritants of the pulp include cavity cleansers such as alcohol, chloroform, hydrogen peroxide, sterilizing and desensitizing substances as well as some of the substances present in various restorative materials and cavity liners.

Pathogenesis

1. Pulpal inflammation is a complex process that involves a wide variety of neuronal and vascular interactions and reactions.

2. The unique responses of the pulpal tissue against the irritants and associated physiological feedback mechanisms can further lead to its injury.

3. Damage to the subjacent cells of the sub-odontoblastic zone and cells deeper to it causes irreversible pulpitis and eventually complete pulpal necrosis.

4. As the necrotic pulp space is relatively inaccessible to the immune response, it becomes a reservoir of the infective process.

5. Interaction of these irritants with the host tissue results in the release of non-specific mediators and immune reaction in the periapical tissues.

Factor Affecting Treatment

1. Status of the pulp and stage of root development

2. Number of visits required

3. Risk of fracture of the root

4. Extent of pulpal damage

5. Restorability of tooth

6. Patient preferences

7. Finances

Types of Open Apices

1. Blunderbuss: Derived from the Dutch word "Donderbus" which means "thunder gun" referring to an 18th century weapon with a short and wide barrel. These are the flaring root canal walls where the apex is funnel-shaped and wider than the coronal aspect of canal (Fig. **1**).

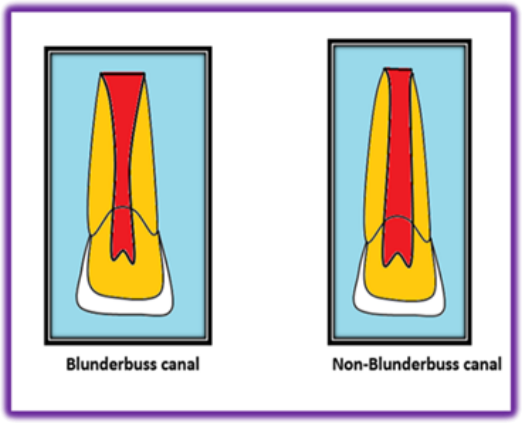

Fig. (1). Types of open apices.

CHAPTER 7

Endodontic Instruments and Irrigants

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Abstract: Pulpectomy is the treatment of choice for pulpally involved deciduous teeth, which potentially eliminates inflamed or necrotic pulp, bacteria, and toxins, relieving pain and promoting periradicular healing by cleaning and shaping the root canals. Over the years, cleaning and shaping of the root canals are done by manual endodontic instruments like files and reamers which are still considered to be the gold standard. With the advent and advances in Nickel Titanium rotary files, rotary endodontic instruments have been widely used for cleaning and shaping the root canals in Pediatric Dentistry. Of rotary files is less time-consuming thereby reducing stress to both the child and the dentist, giving consistent and predictable results even in narrow and curved root canals due to superelasticity and shape memory of nickel-titanium alloy

Keywords: Nickel-Titanium files, Paediatric rotary files, Pulpectomy, Rotary endodontics.

INTRODUCTION

Paediatric dentistry has emerged as a highly specialised branch in which endodontic procedures of deciduous teeth are the major treatment. An endodontic procedure of deciduous teeth preserves function, and esthetics and ensures normal eruption and it is preferred over extraction. It offers quite a few challenges in paediatric patients ranging from limited cooperation of the child to complex root canal morphology. Prerequisite for successful endodontic treatment includes removal of infected or inflamed pulp, toxins and bacteria from the root canals which results in effective infection control thereby relieving pain and permitting healing of periradicular tissue.

The primary objective of cleaning and shaping root canals is to remove soft and hard tissue, giving access for irrigating solutions to the apical part of the canal, creating space for the delivery of medicaments and obturating material along with retaining the integrity of radicular structures [1]. Endodontic instrumentation over

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the years was done by stainless steel files manually, as they have excellent tactile control with sharp and long-lasting cutting surfaces. With limited flexibility of the hand files, accessing narrow constricted canals is difficult and manual preparation of curved canals is laborious resulting in inconsistent preparation of the canals (Fig. **1**) [2].

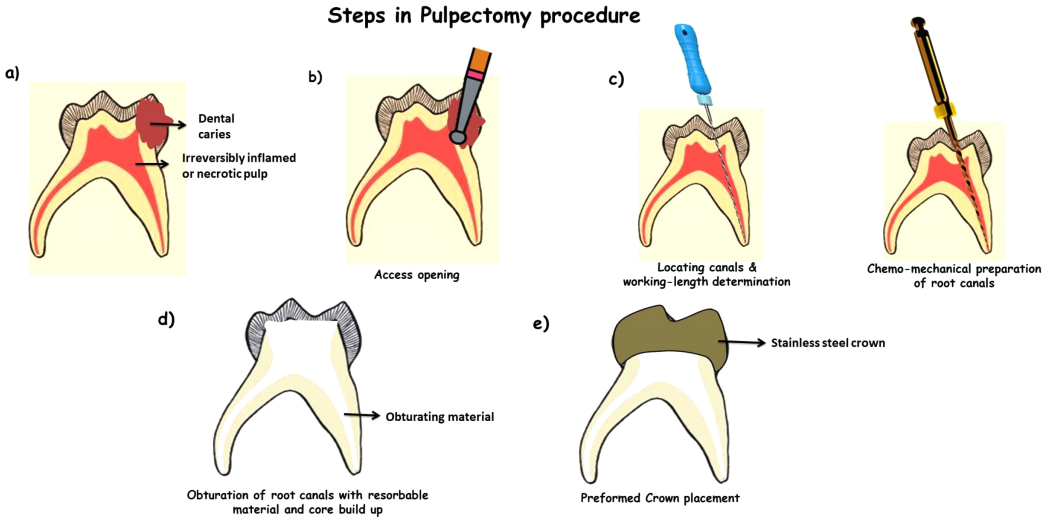

Fig. (1). Pulpectomy procedure with preformed crown placement.

With the advent of Nickel-Titanium alloys (NiTi) in endodontics, a new dimension is added to endodontic instrumentation with several NiTi file systems introduced for chemo-mechanical cleaning and shaping of the root canals providing faster, safer, and consistent root canal preparations.

Nickel-Titanium Instruments

History: George Andreasen & co. pioneered feasible studies on the potential uses of Nickel-Titanium alloys for dentistry. Andreasen and Morrow presented the mechanical properties of this alloy, especially the very low elastic modulus and very wide elastic working range of the alloy compared with stainless steel along with its notable clinical applications. Harmeet Walia thought that Nickel-Titanium (NiTi) alloy due to its very low elastic modulus might have enormous potential for endodontic files which simplifies negotiation of curved root canals with much greater ease than stainless steel instruments available at that time. Walia *et al*. developed the first prototype of NiTi hand files by machining large diameter orthodontic wires and compared it with stainless steel hand files of the same size manufactured by a similar machining process for bending and torsion, with Niti showing promising initial results. With further studies on Niti, innovative dental

manufacturers began to market NiTi endodontic instruments in the 1990s. Subsequently, many other manufacturers introduced NiTi rotary instruments for endodontics. Of late studies on the properties and performance of these instruments became an intensive area for endodontic research.

Features of NiTi Endodontic Instruments

Superelasticity and shape memory: The mechanical behaviour of superelasticity and shape memory of NiTi alloys result from the nature and proportions of their microstructural phases. There are three phases in the NiTi alloys.

1. Austenitic NiTi (austenite) exists at higher temperatures and lower stress and have a complex body-centred cubic structure.

2. Martensitic NiTi (martensite) exists at lower temperatures and higher stress, and have a complex structure described as Monoclinic.

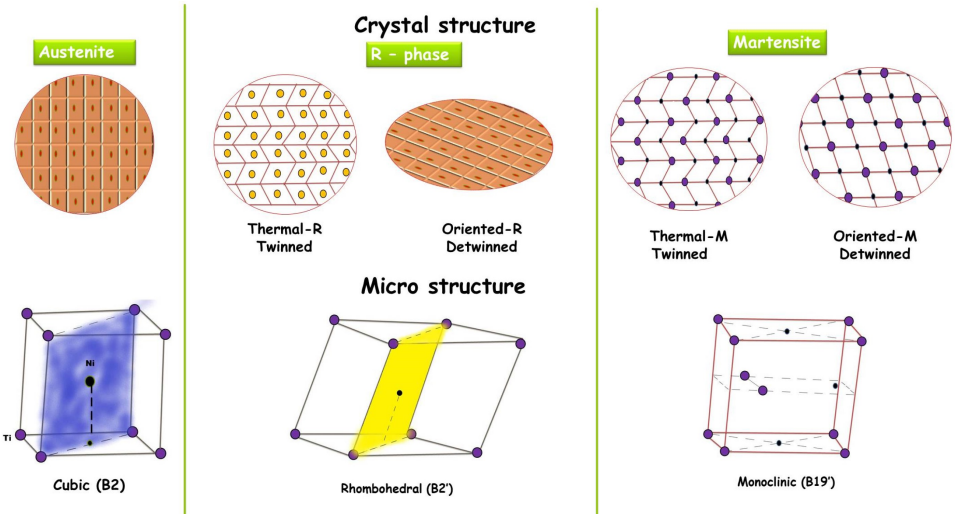

Fig. (2). Crystal and Microstructures of Nickel-Titanium alloy.

3. The R-phase is an intermediate phase that forms during the forward transformation from martensite to austenite on heating and reverses the transformation from austenite to martensite on cooling, possessing a rhombohedral structure (Fig. **2**). At the atomic level, transformation between austenite and martensite occurs by a twinning process and the reversibility of the twinning process is the origin of its shape memory (Figs. **3** and **4**) [3].

CHAPTER 8

Traumatic Injuries to Anterior Teeth: Introduction, Prevalence, and Classifications

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Abstract: Smile with beautiful natural teeth is one of the greatest assets of a person. Untreated fractured teeth can affect day to day activities of children in school which can have a psychological impact on children. Apart from dental caries and periodontal diseases, a traumatic dental injury is the third most common cause of tooth loss. Violence, accidents, falls and sport-related activities are the leading causes of traumatic dental injuries, that majorly involve anterior teeth. Epidemiological studies indicate that dental trauma is a significant problem in young people and that soon, it will be a major dental health care requirement. Prevalence of traumatic dental injury in primary and permanent dentition ranges from 9.4-41.6% and 1% to 58.6%, respectively. The management of traumatic injuries to anterior teeth is also changing with advances in materials sciences and understanding of the mechanism of traumatic injuries.

Keywords: Classification of dental trauma, Prevalence of trauma, Traumatic dental injury.

INTRODUCTION

Oral injuries are most frequent during the first ten years of life, decreasing gradually with age, and are very rare after the age of thirty. Although the oral region comprises a small area of 1% of the total body area, it accounts for 5% of all bodily injuries. In preschool children, oral injuries make up as much as 17% of all bodily injuries, with injuries to the head being the most common. This contrasts with later in life when injuries to hands and feet are the most common. Of all patients seeking consultation or treatment for injuries to the oral region, dental injuries are the most common and are seen in as many as 92% of patients presenting with oral injuries, whereas soft-tissue injuries to the same patients are seen in 28%, often simultaneously with dental injuries. Therefore, mass awareness has to be created in society amongst the children, parents and school teachers who

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are often the first responders, and they have to be educated in terms of preventing and managing traumatic dental injury [1, 2].

Prevalence of Traumatic Dental Injury

In current terminology, the use of the word trauma implies a reasonable severe, non-physiological lesion to any part of the body. Any thermal, chemical or mechanical insult that affects the dentition should be analyzed as a dental trauma and its effect, as a traumatic dental injury. Interpersonal altercations, road traffic accidents, accidental falls, sports activities and non-accidental injuries, have been identified as the major causes that contribute to dental trauma and pose a significant public health problem. These causes especially emerge as an increasingly significant threat to the dental health of children and adolescents. It has been claimed that the volume represented by dental trauma and its sequelae within the near future will probably exceed dental caries and periodontal disease in the young population. Various studies have been conducted to ascertain the prevalence of traumatic dental injuries in different age groups including primary and permanent teeth. These studies have reported a range of prevalence rates. The great variation in reported rates can be attributed to a number of factors, including types of study, classification of trauma used for assessment, methodology, study size and population, geographical location and differences in cultural behavior [3, 4].

The region-wise distribution of traumatic dental injuries has been summarized in the following tables (Tables **1** - **4**) [1, 2].

Table 1. WHO-region wise distribution of prevalence of traumatic dental injury to permanent teeth.

WHO Region	Number of Subjects	Prevalence (%)
World	268755	15.2
European Region	62 389	14.0
Region of the Americas	53 080	19.1
Western Pacific Region	79 177	9.9
South-East Asia Region	41 922	12.2
Eastern Mediterranean Region	17 392	16.0
African Region	14 795	11.1

Table 2. WHO-region wise distribution of prevalence of traumatic dental injury to primary teeth.

WHO Region	Number of Subjects	Prevalence (%)
World	59 436	22.7
European Region	21 869	14.2
Region of the Americas	28 736	26.5
Western Pacific Region	–	–
South-East Asia Region	3312	27.0
Eastern Mediterranean Region	2052	22.7
African Region	3467	22.7

Table 3. WHO-region wise distribution of prevalence of traumatic dental injury to permanent teeth among 12 years old children.

WHO Region	Number of Subjects	Prevalence (%)
World	33 829	18.1
European Region	1693	13.5
Region of the Americas	14 968	22.1
Western Pacific Region	1630	13.3
South-East Asia Region	8133	15.8
Eastern Mediterranean Region	2269	14.9
African Region	5136	13.2

Table 4. Traumatic dental injuries.

Region	Author	Country	Year	Age	Sample Size	Incidence (per 1000/year)
Australia	-	-	-	-	-	-
-	Stockwell	Australia	1988	6-12	66500	17
Europe	-	-	-	-	-	-
-	Hamilton, Hill and Holloway	United Kingdom	1997	11-14	2022	34
-	Skaare, Peterson and Jacobson	Norway	2005	1-8	20000	13
-	Ravn	Denmark	1974	7-16	50000	30
-	Glendor, Hailing Anderson, Eilert-Peterson	Sweden	1996	0-19	Unspecified	13

CHAPTER 9

Traumatic Injuries to Anterior Teeth: Etiology, Predisposing Factors and Examination

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Abstract: Traumatic injuries are commonly seen in children. There are various causes and factors that make an individual or a particular tooth more susceptible to traumatic injury. Owing to factors like early fine motor development of infants and toddlers, participation in sports and other physical activities, accidental and non-accidental injuries or common reasons, children may suffer from dental trauma. Many facial types like convex facial profiles, class malocclusions and malposition of teeth also make the teeth prone to trauma. This section describes the etiologic and predisposing factors and sketches an outline for a detailed examination of traumatic dental injuries.

Keywords: Etiology of dental trauma, Examination of dental trauma.

RISK FACTORS AFFECTING TDI

Nature and severity of traumatic dental injury and its treatment outcomes are influenced by various risk factors that are described in Figs. (**1** and **2**).

ETIOLOGY

While compassion and love are a part of human nature, anger and violence form the other negative end of human behavior. Violence has increased in severity during the past few decades and its role has been underestimated when looking at intentional vs unintentional Traumatic Dental Injuries (TDIs). The WHO Healthy Cities and WHO Health Promoting Schools programs offer a broad solution for dental trauma as a public health problem in an age group which is most vulnerable to trauma.

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Fig. (1). Causes of traumatic dental injury.

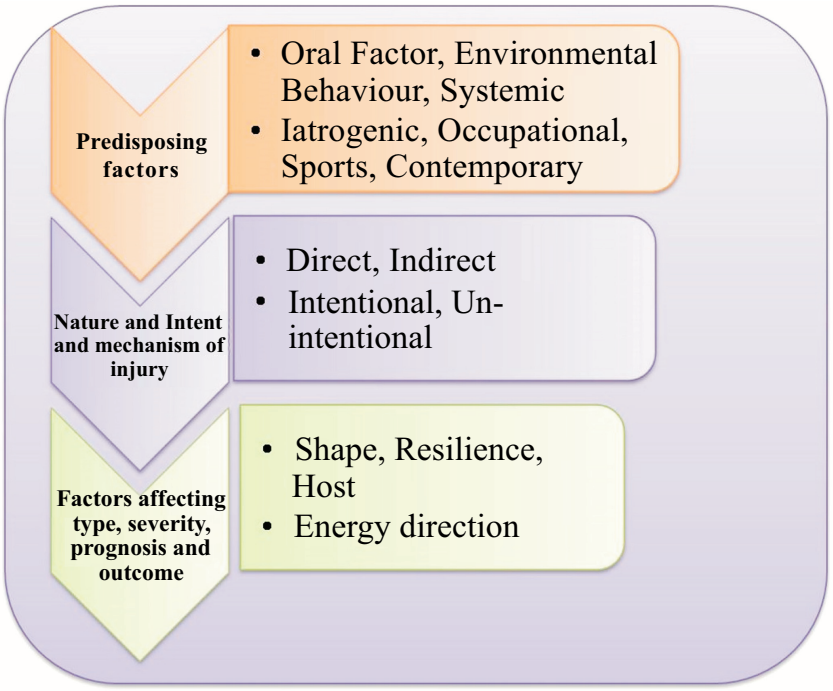

Fig. (2). Etiological of trauma to anterior tooth.

It was revealed that falls were the main common cause of traumatic dental injuries (from 31.7 to 64.2%) followed by sport activities (up to 40.2%), bicycling accidents (up to 19.5%), traffic accidents (up to 7.8%), and physical violence (up to 6.6%). Amongst all the causes, traffic accidents constitute a special group of traumas due to predominant multiple injuries including head injuries and trauma to supporting tissues. Moreover, new types of facial trauma occur from airbag explosion in cars during traffic accidents. Bicycling accidents are a common cause of dental trauma in schoolchildren. Various studies conducted throughout the world confirm that wearing a helmet during bicycle ride can minimise or reduces the incidence by 65 percent [1, 2].

Sport activities are one of the main causes of dental trauma, they are classified as contact sport and non-contact sports. The contact sports are further divided according to their risk categories: high-risk (boxing, soccer, American football, hockey, martial sports, rugby, cycling and skating) and medium-risk sports (cricket, baseball, basketball, handball, diving, squash, and gymnastics) (Table **1**).

Table 1. Types of sporting activities.

High Risk Sports	Medium Risk Sports
Boxing	Cricket
Soccer	Baseball
American Football	Basketball
Hockey	Handball
Martial sports	Diving
Rugby	Squash
Cycling	Tennis
Skating	Gymnastics

The tendency of increase in the severity of violence among individuals concerning traumatic dental injuries is an alarming factor. It is important to emphasize that dentists could be the first ones to detect children who had suffered physical abuse and non-accidental injuries. In the united states, the findings reveal that nearly 30 per cent of dentists had a suspicion about child abuse however only 9 to 14 per cent reported it.

Compared to non-oral accidents, bicycle-related oral injuries seem to be more frequent up to the age of 14 years. Biting a pen, opening soda bottles, hair clips, food packages, attempting to repair electrical devices or replacing batteries, cutting or carrying items, and opening screw top bottles are among the most frequent improper uses of teeth mentioned in the literature. TDI can also occur in

CHAPTER 10

Traumatic Injuries to Anterior Teeth: Management of Trauma

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Abstract: Management of traumatic dental injuries has remained a problem for the dental surgeons due to the wide range of clinical presentations and the unpredictable nature of the pulpal response. Combined with the anxiety and fear at the time of the trauma. Trauma also makes the children apprehensive about any treatment. The approach to the management of traumatic dental injuries, must be customized according to age, general vital signs, systemic conditions, growth potential, and type of trauma to the individual tooth or supporting structures. Each type of traumatic injury has a unique approach and the evidence for their management is updated from time to time. Hence it is important to keep the latest recommendations in mind while adhering to the traditional time-tested methods in the management of traumatic injuries in children.

Keywords: Avulsion, Luxation, Management, Pediatric Dental Trauma, Splinting of Teeth, Traumatic Dental Injuries.

MANAGEMENT

Any traumatic injury to the dentition has a psychological bearing on the mind of the child and parents. Esthetic value of anterior teeth becomes a primary factor in the "psychological well-being" of a person. An unacceptable or improper restoration of fractured tooth often leads to a sense of inferiority, which may be a direct factor in the social acceptance of the child in future. In this situation, efficient treatment planning becomes crucial for successful management of these cases. Even a small fracture of the enamel edge may make a child conscious about their appearance and alter their patterns of social skill development including smiling as they may not be comfortable to display their broken teeth [1].

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***Emergency treatment*:** Immediate treatment must be rendered in case of trauma for the clearance of the airway passage and control of bleeding. When there is suspicion of neurological involvement or medical emergency, physician/surgeon should be communicated, or patient should be shifted to tertiary care center. Any loose fragments of tooth should be accounted for and aspiration or embedment of these fragments in soft tissues should be ruled out.

***Emergency treatment of soft tissue injury*:** soft tissue wounds should be cleaned and debrided carefully. Control of bleeding should be of paramount importance. All efforts should be directed towards control of bleeding before dental examination is contemplated. If abrasion is shallow debridement may be the only treatment required. In deeper wounds care should be taken to ensure that no tooth fragment or foreign body like gravel are embedded in the tissue. The dentist must recognize the possibility of the development of tetanus after the injury and must carry out adequate first aid measures. Soft tissue injuries are associated with swelling and distortion of tissues. This leads to a panicky situation for the parents as they are worried about the extensive swelling. Soft tissue swelling should also be evaluated from the perspective of airway obstruction [1 - 3].

MANAGEMENT OF DENTAL TRAUMA [4, 5]

Ellis Class I Fracture (Fig. 1)

Clinical Features

Loss of enamel is observed in form of fractured incisal edge or angle. No sign of dentin or pulpal involvement is present. Pain if present is secondary to any other associated TDI as root fracture or luxation.

Fig (1). Ellis class I trauma involving enamel only.

Investigations

Ellis class I trauma require IOPA radiographs and pulp testing. Radiographs are helpful in ruling out any root fracture while the pup testing establishes a baseline

observation against which future comparisons can be made. In cases of soft tissue lacerations concomitant with enamel fractures, it must be radiographed to search for broken tooth fragment.

Treatment (Fig. 2)

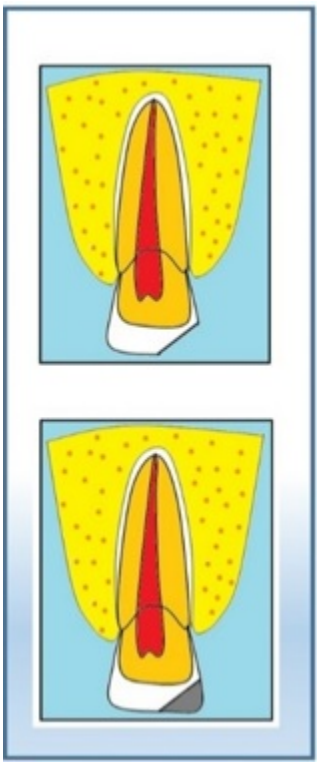

Fig (2). Ellis class I treatment.

a. Re-contour injured tooth
b. Apply fluoride varnish to prevent sensitivity (Duraphat 5% / Fluorprotector 1%)
c. Treatment of choice is "Fragment Reattachment" if patient reports with the fractured part. The method of reattachment is simple and requires stability during composite bonding. If the patient does not have the fragment, composite resin restoration and contouring are done. Care must be taken to seal the entire fracture line for better prognosis.

Follow up

A follow up of 6-8 weeks and 1 year later with clinical and radiographic evaluation has been recommended in these cases.

CHAPTER 11

Sports Related Dental Injuries

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Abstract: Sports dentistry is an emerging section of dentistry. All sports-associated persons must have knowledge about injuries during all sports-related events. Since the very beginning, it has been known that participation in sports carries an extensive risk of sustaining dental injuries, with the increased popularity of sports like contact sports, semi-contact sports, and more support for children to participate at an early age. Dental injuries have become one of the most recurrent types of orofacial injuries that may occur during involvement in various sports activities and have a high rate of incidence between sports-related injuries normally during school physical education classes and club activities. The commonest orofacial injuries involve both soft tissue and hard tissue injury i.e.: facial bones, tooth intrusions, luxation, crown and root fractures, complete avulsions, and Dento-facial fractures. Prevention is of utmost importance to aesthetics for reducing the psychological and economic consequences of traumatic injuries. The most substantial feature in averting sports-related orofacial injuries is wearing protective devices like face masks, mouth guards, and helmets. The use of these protective devices by athletes has been shown to provide an effective safeguard against suffering.

Keywords : Mouthguard, Sports Dentistry, Sports Injuries.

INTRODUCTION

The face is the most exposed area of the body and is usually the least protected. Sports-related facial injuries account for 8% of all facial soft tissue injuries. Nearly 11-40% of all sports-related injuries involve the facial regions [1]. Sports dentistry is referred to as the branch of sports medicine that deals with the prevention and treatment of dental injuries and related oral diseases associated with sports and exercise (Table **1**). This branch of dentistry had its beginning in the 1980s and is related to the prevention and therapy of orofacial injuries occurring in athletes. In general, about 13% of trauma to the orofacial structures in children arises due to sports-related activities. Numerous dental injuries experienced throughout sports are avulsion, luxation injuries to the tooth,

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concussion, and fracture of the facial bones [2]. Dental trauma in sports is the major linking channel between sports and dentistry. The combined impact of violence, traffic accidents, and sporting activities has contributed to the establishment of traumatic dental injuries as a public dental health problem.

Table 1. Definitions.

Sports	**"A sport is an organized, competitive, entertaining, and skillful activity requiring commitment, strategy, and fair play, in which a winner and loser can be defined by objective means."**
Contact Sports	"Contact sports are defined as those sports in which players physically interact with each other, trying to prevent the opposing team or person from winning."
Semi-contact Sports	"Semi-contact sports are those sports in which body contact occurs sometimes as per the demands of a situation. For example, Football, Hockey. Limited contact sports, like volleyball, basketball, and fencing, have a high probability of occasional, inadvertent contact, mostly due to loss of balance or control."
Non-contact Sports	"Non-contact sports are sports where participants compete alternately, in lanes, or are physically separated such as to make nearly impossible for them to make contact during a game without committing an out-of-bounds offense, or more likely, disqualification. Examples include precision sports such as golf or curling, tennis, cricket, volleyball, swimming, sprinting, and gymnastics."
Sports Dentistry	"Is a branch of dentistry that is closely related to dental traumatology and includes prevention and treatment of sports-related dental/orofacial injuries, information collection, information dissemination, and promotion of research on the preventive procedures related to injuries of such a specific etiology."

Epidemiology of Sports-Related Dentistry (Table-2)

Today more children are getting involved in sports activities and their involvement is beginning at an earlier age. Sports account for 36% of injuries to children and youth. Injury rates are even higher for unorganized sports. Participation in organized and recreational sports poses a significant risk of dental injuries. Dental injuries are one of the most common types of injuries sustained by athletes. They are also one of the most preventable types of sports-related injuries. The table below depicts the causes and types of sports-related injuries.

SPORTS-RELATED INJURIES

Common Athletic Injuries

Soft Tissue Injuries

Soft tissue injuries to the face are common and this is the most exposed part of the human body to get injured. Certain common soft tissue injuries include Abrasions,

contusions, and lacerations [3]. These soft tissue injuries (Fig. **1A**) are likely to happen most commonly on top of the bony prominence of the facial skeleton. Lacerations of the lip can also be seen as a regular injury.

Table 2. Epidemiology of sports-related injury.

Cause/ (%)	Type of injury (%)
Bicycle (9.3)	A crown fracture not involving pulp (42.7)
Swimming/diving 4.9	A crown fracture involving pulp (4.6)
Impact with person (15.9)	Root fracture (0.4)
Impact with object (15.3)	Luxation (3.5)
Hit by ball (3.7)	Avulsion (4.0)
Unspecified (13.2)	Concussion (1.0)

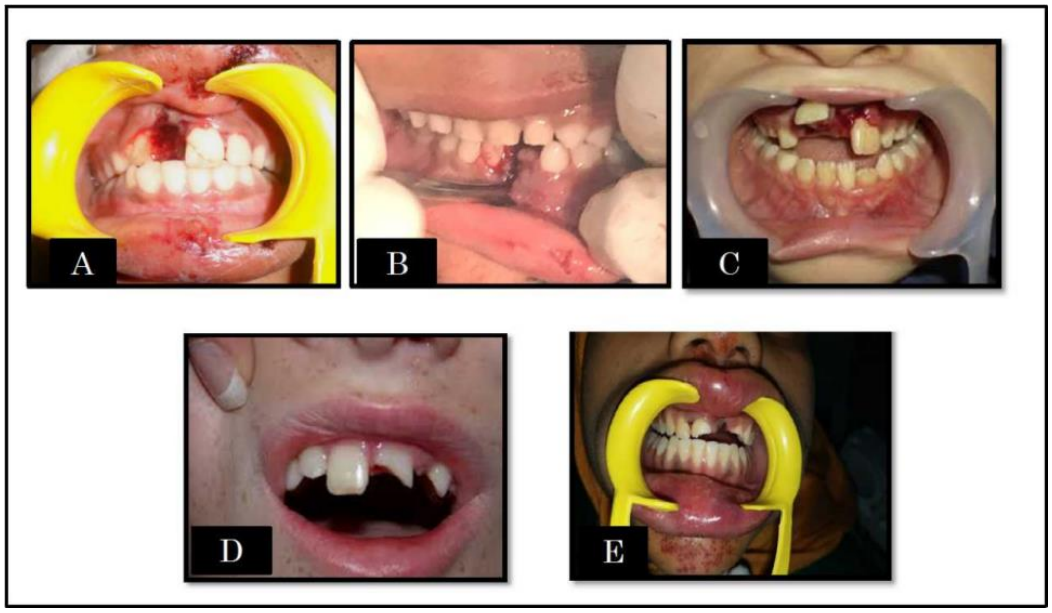

Fig (1). -Type of injury: A - Soft tissue injury, B - Fracture of mandible, C - Tooth intrusion, D - Crown fracture, E - Avulsed tooth

Fractures

The cheekbone (zygoma) is the most recurrent area of trauma in the facial bonAbout 10% of the maxillofacial fractures are seen in this region. A study was conducted by Linn and coworkers in which 319 patients were examined who were given treatment for sports-related injuries; the outcome proved that males were more prone to fractures of zygoma as compared to females and it is due to the

CHAPTER 12

Saliva and Oral Health

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Abstract: The mouth is a window to the body, and saliva plays an essential role in maintaining the integrity of oral structures. Saliva is that complex fluid that controls oral health through specific and nonspecific physical and chemical properties. The significance of saliva in our everyday activities and its medicinal properties are often taken for granted. However, when disruptions occur in the quality or quantity of saliva in an individual, he or she will likely experience detrimental effects on oral and systemic health. Often head and neck radiotherapy have serious and detrimental side effects on the oral cavity, including the loss of salivary gland function and a persistent complaint of a dry mouth (xerostomia). Thus, saliva has many beneficial functions that are essential to our well-being. Although saliva has been extensively investigated as a medium, few laboratories have further studied saliva's role in maintaining oral and general health and found saliva as a fascinating biological fluid that possesses the features of a perfect diagnostic tool. The presence of microbial, immunologic and molecular biomarkers in saliva offers these unique opportunities. These biomarkers aid in the early diagnosis and monitoring of oral diseases such as, dental caries, oral malignancies, infectious diseases and many more. Saliva has proved to be a good substrate for the early detection of oral diseases to evaluate therapeutic responses.

Keywords: Diagnostic Tool, Oral Health, Saliva, Salivary Gland, Salivary Immunoglobulins, Salivary Biomarkers, Sialorrhea, Xerostomia.

INTRODUCTION

Despite great improvements in the oral health of people in several countries, it is still a persistent global problem. Oral diseases such as dental caries, periodontal diseases, tooth loss, oral cancers, and oro-dental trauma have remained major public health problems. Poor oral health has a profound adverse effect on general health. Saliva is crucial for the health and proper functioning of the oral cavity.

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Saliva is a biological fluid secreted by major and minor salivary glands. The major salivary glands are parotid, submandibular, and sublingual glands. Minor salivary glands are widely disseminated in the entire oral cavity. Saliva provides lubrication; facilitates mastication, digestion, and taste; it has antimicrobial properties; and serves as a buffer for acidic food. Moreover, saliva inhibits the demineralization of enamel and protects from caries. The physiological secretion generates 0.75–1.5 L per day, with a decrease during the nighttime. Saliva contains 99% water and the remaining 1% (mucins, enzymes, immunoglobulins), electrolytes, lipids, and inorganic substances.

Dilution of quantity and quality of saliva is associated with complications which increases the suffering and leads to many diseases. However, the presence of a systemic disease impacts salivary microbiota. Thus, saliva, a diagnostic tool in predicting future disease risk would be a significant help in precision medicine. There are many advantages to utilizing saliva as a substrate for diagnostic analysis [1].

Physical Properties of Saliva

Saliva is the watery mixture of secretions from the salivary and oral mucosal glands that lubricate chewed food, moisten the oral walls, and contain ptyalin. Table (**1**) depicts the physical properties of saliva which are imparted by its constituent elements.

Table 1. Physical properties of saliva.

S. no	Physical property	-
1.	Daily secretion	500-1500ml/24 hours
2.	Flow rate	0.25-0.5ml/min
3.	Consistency	Cloudy, colourless, opalescent fluid
4.	pH	Whole saliva:6.35-6.85 Parotid gland saliva: 5.5-6.5 Submandibular and sublingual gland saliva: 7.0-7.5
5.	Specific gravity	1.002-1.012
6.	Freezing point	0.07˚C- 0.34˚C
7.	Viscosity	Parotid gland saliva: 1.5 Submandibular gland saliva: 3.4 Sublingual gland saliva: 13.4

Composition

Saliva is an exceptionally dilute fluid, composed of more than 99.5% water and 0.5% solids. The solids are further classified as organic, inorganic, cellular and gases (Fig. **1**).

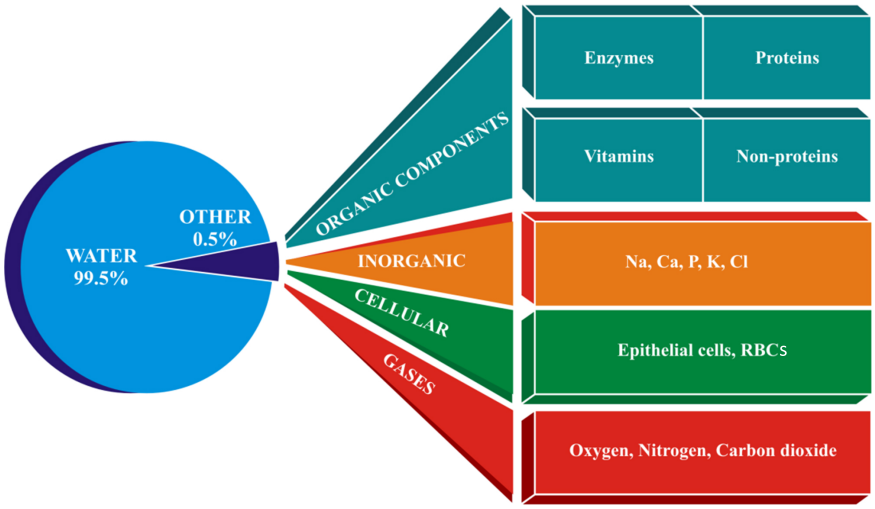

Fig (1). Composition of saliva.

- **Organic components-**
  a. **Enzymes:** amylase, lingual lipase, lysozyme, esterase, maltase, kallikrein
  b. **Proteins:** mucins, lactoferrin, albumin, immunoglobulins, blood group antigens, Interferon-gamma (IFN-g) levels
  c. **Non- proteins**: nitrogenous substances: urea, creatinine, sialin, statherins.
  d. Vitamin B-complex and vitamin C
- **Inorganic components -** Sodium, calcium, potassium chloride, bicarbonate, fluoride, phosphate, iodine, magnesium

Major salivary glands contribute most of the secretory volume and electrolyte content to saliva, whereas minor salivary glands contribute little secretion volume and most blood-group substances. Fig. (**1**) illustrates the composition of whole human saliva.

Factors Affecting the Salivary Secretion

Multiple factors influence the salivary flow and its composition. Hence, great variations are seen among individuals and the same individual under different circumstances. Following are the factors that affect the physical and/or chemical properties of saliva.

CHAPTER 13

Systemic Fluorides and Dental Health

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Abstract: Dental caries remains a significantly prevalent public health problem globally for both developing countries and deprived inhabitants in developed countries. The WHO Oral Health Programme persists in emphasizing the importance of public health methods for the effective use of fluorides in the prevention of dental caries. Early research and development were concerned with waterborne fluorides, both naturally occurring and their controlled addition, with emphasis on the effects of fluoridation on the prevalence and incidence of dental caries. More recently, systematic reviews summarizing these extensive databases have indicated that water fluoridation and fluoride toothpaste both substantially reduced dental caries. Fluoride must be present in the right place, namely in saliva and dental plaque at the right time to interfere with the tooth decay process. This process is a swing and balance affair between acid dissolution and remineralization of the tooth surfaces. In addition, in conditions where the incidence and prevalence of dental caries in the community are high to moderate, or when there are firm indications that the incidence of caries is increasing, a supplementary source of fluoride should be contemplated.

Keywords: Community Oral Health, Dental Caries Prevention, Fluorides, Systemic Fluorides.

INTRODUCTION

Once in a millennium, we come across significant discoveries, the ramifications of which span an entire century. One such discovery was the inverse correlation between the prevalence of dental caries and fluoride concentration which is a great forward stride in the field of public health. The fact that the presence of fluoride in drinking water drastically decreased the prevalence of dental caries was established in the 1940s, although the mechanism of action was not known, it

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was thought to be primarily systemic. Since then, various preventive measures and programs using fluoride were implemented in controlling dental caries. A substantial decline in the caries prevalence has been observed in different parts of the world during the last 15-20 years, both in countries using water fluoridation as a caries preventive measure and in countries without water fluoridation. It is remarkable that caries reduction has occurred at the same time and with similar magnitude in regions which are far apart like the Nordic region (North Europe and North Atlantic countries) on one hand and Oceania region (Australia and New Zealand) on the other.

Many countries have used fluoride in different forms for caries prevention like community water fluoridation programs, salt fluoridation and fluoride tablets, but more emphasis has been given to topical fluorides by most countries. However, one aspect which remained common for the prevention of dental caries at the community level is fluoride which endured the test of time and various trials. Fluorides now have become an integral part of every oral health program and WHO had passed a resolution at World Health Assembly in 2007, that universal access to fluoride for caries prevention was to be part of the basic right to human health (Fig. **1**).

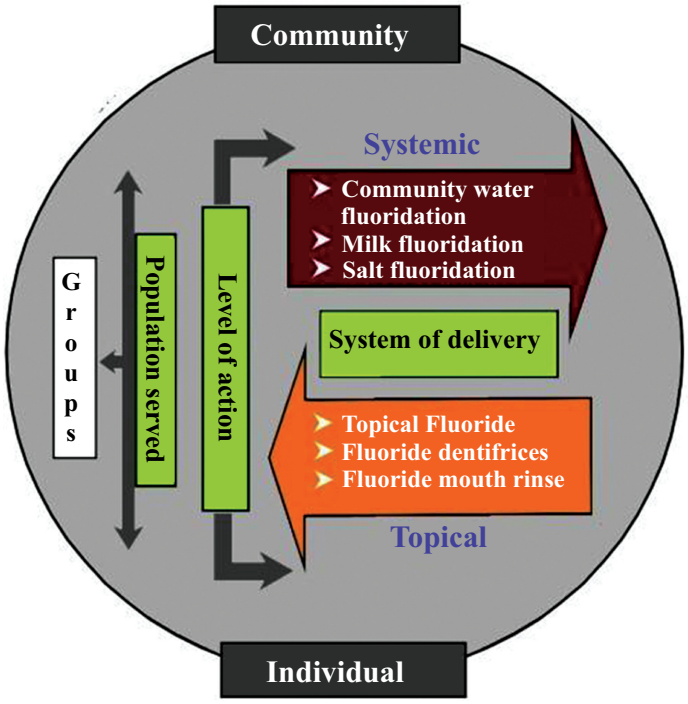

Fig (1). Fluoridation program for prevention of Dental caries.

Historical Evolution of Fluorides

In 1901, Dr Fredrick McKay in Colorado Springs, Colorado, USA, started detecting a permanent stain on his patient's teeth, particularly those who had lived in that area all their lives, and the locals called it **'Colorado Stain'.** McKay was not able to find any reference to them in any of the available scientific literature. He described the stain by calling it 'mottled enamel' as: A minute white flecks, or brown or yellow spots or areas, which are scattered irregularly or streaked over the surface of a tooth, or it may be a condition where the entire tooth surface is of a dead paper-white like the colour of a China dish.

Important Milestones in the History of Fluorides

1901: Dr Fredrick McKay of Colorado (USA) discovered permanent stains on the teeth of his patients, which were referred to as **'Colorado stains'** and he named it '**Mottled Enamel'.**

1908: McKay at the annual meeting of the State Dental Association in Boulder said that this condition was not only confined to Colorado but extended to other towns as well.

1912: McKay came across an article written by Dr I.M. Eager (1902), a U.S. Marine hospital surgeon stationed in Italy who reported that a high proportion of Italian residents in Naples had ugly brown stains on their teeth known as **"Denti di chiaie".**

1916: In a major study by McKay and G V. Black, who examined 6,873 individuals and reported that mottled enamel develops due to the presence of an unknown factor in the domestic water that the people ingested during the period of enamel calcification.

1930: Another interesting finding observed by Kemp and McKay is that there was no mottling of enamel occurred in people who grew up in Bauxite before 1909, the year in which Bauxite had changed its supply from shallow wells to deep drilled wells.

1931: Churchill H.V., the chief chemist of an aluminum company in New Kensington, Pennsylvania, after thorough spectrographic analysis of the rare elements, noted that Fluoride was present in Bauxite water at a level of 13.7 ppm.

1931: **Shoe leather survey**- Trendley. H. Dean was assigned the job to continue McKay's work and to find out the extent of the geographical distribution of mottled enamel in the U.S. by the U.S. Public Health Service. About 5,824 children from 22 cities in 10 states were screened for fluorosis and found that

CHAPTER 14

Topical Application of Fluorides

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Abstract: Fluoride is present in natural water sources and occurs as an ionic form of fluorine trace element. It is a safe and effective agent used primarily to prevent dental caries, especially in children. Fluoride can remineralize calcium hydroxyapatite crystals in enamel by forming acid-resistant calcium fluorapatite crystals. It can be administered topically as well as systemically. Topical fluorides form a vital part of preventive oral health programs and help promote enamel remineralization, inhibit bacterial metabolism, and reduce the growth of bacteria in plaque. Various methods for delivering topical fluorides include self-applied toothpaste, gels, mouthwashes, professionally applied varnishes, and other gel forms. This chapter provides an overview of the different topically applied fluoride agents, their mechanism of action and the recommendations for their use in children.

Keywords: Dental Caries, Fluorides, Prevention.

INTRODUCTION

Fluoride has been the most critical caries preventive agent that has decreased the incidence of dental caries in recent decades. The Food and Drug Administration (FDA), United States and the World Health Organization (WHO) recognize fluoride as an essential nutrient and a vital trace element for normal growth and development. It can be administered systemically and topically and is a routine procedure performed in pediatric dentistry. The basic fluoride regimen recommended for preventive dental purposes is fluoridated toothpaste twice daily.

In 1969, WHO advocated using one ppm fluoride in community water and the introduction of topical fluorides for individual needs [1]. In communities with access to water fluoridation, topical fluoride application is limited to individuals at moderate to high risk for developing caries. Regular topical application may be considered for children in areas lacking systemic fluoridation facilities, having

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suboptimal fluoride in drinking water and minimal usage of fluoride dentifrice due to a lack of knowledge [1].

Topical fluorides are fluoride-containing agents applied to the tooth surfaces at regular intervals to prevent caries. They exhibit anti-caries action by increasing the fluoride concentration in the outermost enamel surface [2].

Topical fluorides in the form of gels, foams, toothpaste and varnishes are considered the standard cornerstone in caries prevention for children and adolescents. Levels of fluoride in the saliva are crucial to assess the effectiveness of any topical fluoride agent. Salivary fluoride levels as low as 0.03–0.5 mg/L are considered effective and adequate to limit the demineralization process and promote enamel remineralization [3].

The protective ability of fluoride against dental caries is mainly due to its topical action and renders maximum protection to the smooth enamel surfaces. Consistent low fluoride levels in the oral environment prevent caries more effectively than high fluoride concentration with a prolonged time interval between subsequent exposures.

General Mechanism of Action of Topical Fluorides [4]

- Increased resistance to demineralization of the tooth structure.
- Enhancing remineralization of the demineralized tooth structure.
- Inhibition of the bacterial metabolic enzymes (enolase) necessary for acid formation.
- Inhibition of the adhesion of the plaque/ biofilm to the tooth structure.

Topical Fluoride Delivery Methods

Topical fluorides can be self-applied and professionally applied (Fig. **1**).

Self-Applied Fluorides

Individual patients may use self-applied fluoride agents independently but only at a dental professional's recommendation. They contain fluoride in low concentrations ranging from 200-1000 ppm or 0.2-1.0 mg F/ml. Various types of self-applied fluorides used are:

1) Fluoride Dentifrices

Fluoride dentifrices are comprised primarily of abrasive or polishing agents, detergents, binders, and flavouring agents. Sodium fluoride is the first active agent added to conventional dentifrices with dicalcium phosphate abrasives. It

was followed by stannous fluoride incorporation, which was recognized and approved by the FDA (Food and Drug Administration) and ADA (American Dental Association).

Individuals brushing their teeth twice daily or more using dentifrices containing 1000 ppm or 1500 ppm or 2500 ppm of fluoride have been seen to significantly reduce the prevalence of caries [5].

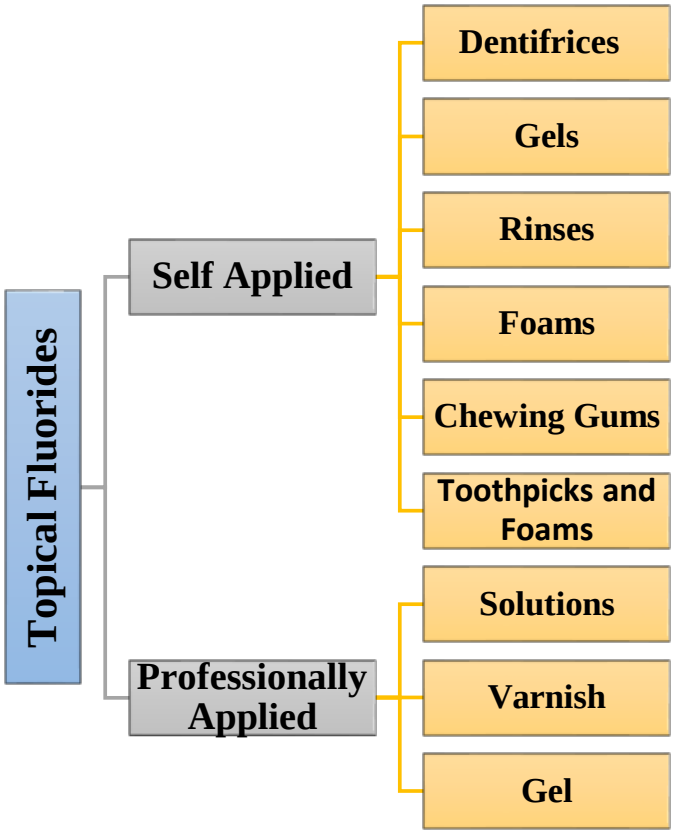

Fig (1). Illustrative diagram showing types of topical fluorides.

Fluoride Compounds in Dentifrices

- Sodium Fluoride
- Stannous Fluoride
- Monofluorophosphate
- Amine Fluoride
- Sodium hexametaphosphate

CHAPTER 15

Silver Diamine Fluoride and its Role in Prevention

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Abstract: Silver diamine fluoride (SDF) is a colourless and odourless combination of silver and fluoride solution with caries arresting properties. Clinical and in-vitro trials have proven its preventive efficacy for caries in high-risk individuals, which is considered a minimally invasive approach for arresting caries progression in cavitated teeth. This chapter gives an overview of the rationale of caries management by SDF, the mechanism of action, and the current evidence for its effectiveness as an anti-caries agent. The safety of SDF use in humans and its various limitations are also explained in the chapter.

Keywords: Anti-Caries Agent, Remineralization, Silver Diamine Fluoride.

INTRODUCTION

Silver diamine fluoride is a colourless liquid composed of silver, fluoride, and ammonia. It is available in various concentrations, of which 38% is considered the most effective. It is alkaline with a pH of 10. It forms a complex with ammonia; the silver particles have antimicrobial properties and act along with fluoride to prevent and arrest caries. SDF can arrest the progression of caries and prevent the development of new carious lesions. Its applicability as a preventive or therapeutic approach can help prevent or delay the requirement of extensive dental treatment until a child acquires a cooperative stage. SDF provides a much more easy-to-use and effective non-surgical alternative treatment for young patients with early childhood caries compared to traditional restorative options [1, 2].

Paradigm Shift

The bactericidal activity of silver ions has been known since ancient times. The first dental use of silver nitrate was in 1846 to treat erosion. Japan was the first country to approve SDF as a therapeutic agent in the 1960s. Since then, SDF has

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been in the international market for over 40 years now, and in 2014, the United States Food and Drug Administration (FDA) cleared the use of SDF in the form of a commercially available 38% SDF solution [3].

Mechanism of Action [4-6]

Silver Diamine Fluoride Acts in the Following ways to Prevent and Halt the Caries Process (Fig. **1**).

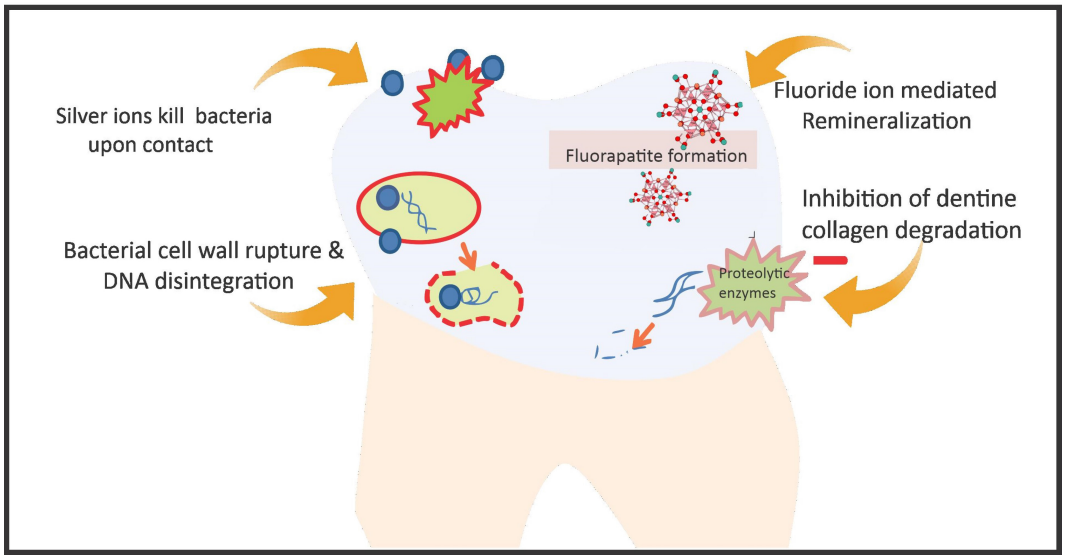

Fig. (1). Action of SDF on cariogenic bacteria.

- **Remineralization:** This is mediated by the fluoride ions (44,800 ppm) present in SDF that causes the formation of fluorapatite, silver phosphate and calcium fluoride compounds which enable remineralization and inhibit the demineralization process by rendering the treated surface more resistant to bacterial acids.
- **Bactericidal Activity:** The silver ion can penetrate up to 2 mm into a deep carious lesion to exhibit bactericidal effects. It interferes with bacterial metabolic processes by inhibiting DNA replication and cell wall synthesis leading to its rupture. The ionic silver may diminish the bacterial motility, or the organisms may be killed entirely. This inhibition occurs by the 'zombie effect' in which the active bacteria are killed upon contact with the silver-affected bacteria, ultimately causing plaque biofilm disintegration.
- **Inhibition of Collagen Degradation:** The progression of caries involves the destruction of the organic components of the tooth as well, which is comprised mainly of type 1 collagen. SDF can inhibit collagen degradation by inactivating

proteolytic enzymes like matrix metalloproteinase (MMP-2, MMP-8, MMP-9) and cathepsins in dentine that are a part of the caries process.

The Overall Reaction can be Summarized as:

$$Ca_{10}(PO_4)_6(OH)_2 + Ag\ (NH_3)_2F = CaF_2 + Ag_3PO_4 + NH_4OH$$

The silver diamine solution reacts with the tooth minerals composed of the hydroxyapatite crystals forming a fluoride reservoir for remineralization. The silver compounds produced are responsible for the darkening of the lesion due to silver ion precipitation.

Indications and Contraindications of SDF (Fig. 2 and 3)

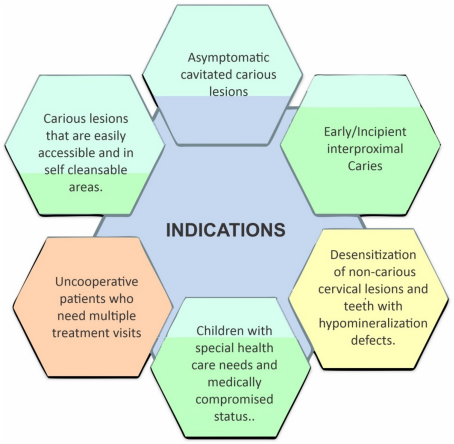

Fig. (2). Indications.

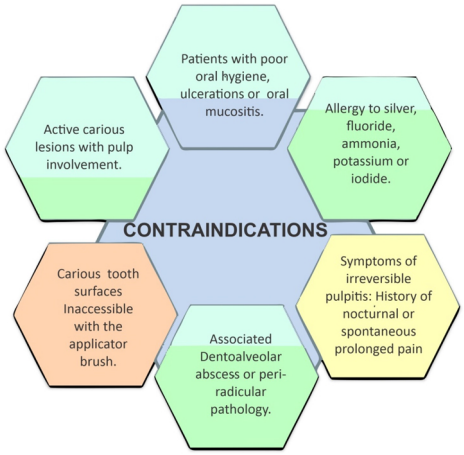

Fig. (3). Contraindications.

CHAPTER 16

Pit and Fissure Sealants

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Abstract: Newly erupted posterior teeth in both the primary and permanent dentitions are vulnerable to dental caries attack due to deep, uncoalesced, and not-so-soundly mineralized pits and fissures as compared to their matured counterparts. Therefore, it is more important to "catch them young" before it becomes too late to save them from the deleterious effects of dental caries. Sealing such immature morphological structures with an appropriate sealing material is one of the primary prevention strategies Though this therapy sounds and appears simple, when conducted improperly, it results in the failure of the treatment motto. Hence, there is a need to gain in-depth knowledge of the material, intricacies in the proper selection of the teeth, technique and the behavior of the therapy eventually.

This chapter provides an overview of the historic background and recent evidence-based clinical recommendations for the use of fissure sealants. It describes the different morphological variants of fissures and a wide range of commercially available products with their dispensing means. This writeup also enlightens the conceptual understanding of sealing non-cavitated fissures, therapeutic fissure sealing and smooth surface sealing. Troubleshooting in sealant therapy along with adverse reactions is also described.

Keywords: Dental Sealants, Glass Ionomer Sealants, Occlusal Caries, Pits and Fissures, Preventive Resin Restorations, Primary Prevention.

INTRODUCTION

Oral diseases have a high prevalence in society, the most common being dental caries, which is caused by an ecological imbalance between demineralization and remineralization [1]. The occurrence of dental caries in the oral cavity is more predominant on the occlusal surfaces of posterior teeth, *i.e.,* deciduous molars, premolars and permanent molars. The pits and fissures on these surfaces are inaccessible to conventional oro-physiotherapeutic measures. Hence, there is an

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accumulation of food remains (debris) and formation of a biofilm. Dental caries is a result of all these events (Fig. **1**) [2]. Even the 21st century statistical data show that 90% of occlusal surfaces of the permanent molars and premolars and 40% of primary molars are affected by caries. Thus, it is a global burden affecting the health and quality of life of children and young adults. Definitive approaches to prevent caries are regular oral hygiene with fluoride-containing toothpaste, a reduction in the intake of cariogenic food, as well as local and systemic fluoridation [3]. Regrettably, fluoride is ineffective in preventing occlusal caries as compared to smooth surfaces as the data from fluoridated communities suggest a low reduction in pit and fissure lesions. Earlier, treatment of caries involved removal of the caries along with healthy tooth structure for the purpose of extension for prevention. Therefore, to prevent and preserve the loss of natural tooth structure, Buonocore in 1955 revolutionized operative dentistry by introducing the concept of "sealing out" caries to prevent the further progress of the carious lesion and thus conserve natural tooth structure [4]. Occlusal sealants are organic polymers which mechanically bind to acid etched enamel. The resin forms an impervious barrier between the occlusal fissures and oral environment, preventing impaction of food debris and ingress of bacteria. If the sealant is present, the occlusal surface is virtually immune to caries attack. The use of sealants focuses on a preventive philosophy, with a desire to preserve tooth structure by preventing or delaying the need for restorative treatment, thus making it a cost-effective treatment. Over the time, various technological advancements led to refinements in the techniques of adhesive dentistry, which enhanced "the power of prevention" [4].

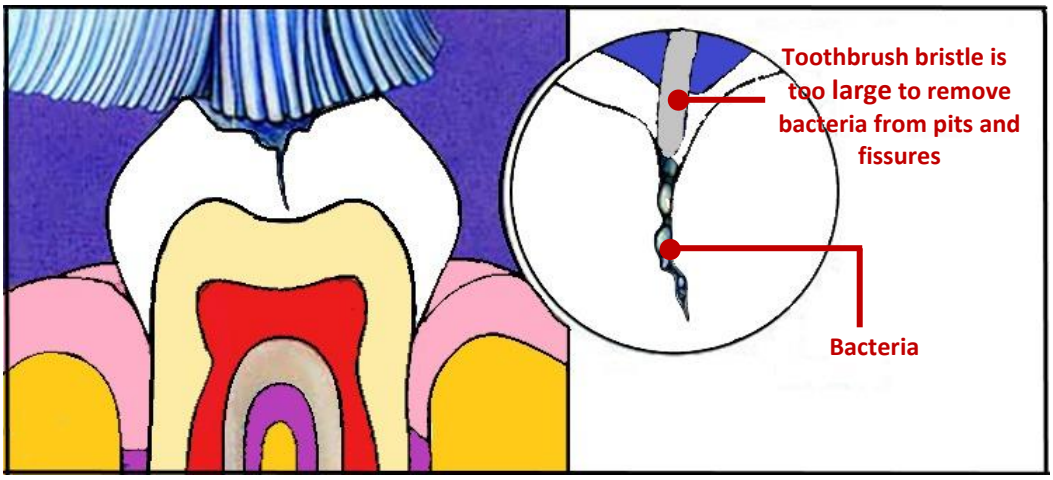

Fig (1). Food and plaque gain access deep into the groove where a toothbrush bristle cannot reach, and a cavity develops easily.

Definition

Pit and Fissure Sealant

According to Simonsen (1978)- the term pit and fissure sealant is used to describe a material that is introduced into the occlusal pits and fissures of caries-susceptible teeth, thus forming a micromechanically bonded, protective layer cutting the access of caries-producing bacteria from their source of nutrients.

Historical Background

Protecting the pits and fissures of newly erupted teeth from caries is not a new concept. Since 1923, when H T Hyatt first suggested prophylactic odontotomy, researchers have put forth different concepts and techniques to decrease caries susceptibility (Table **1**) [5].

Table 1. Landmarks in the history of fissure sealants.

Year	Landmark
1867	Arthur stated that "decay is inevitable, and obliteration of fissures could prevent its occurrence."
1895	Wilson used zinc phosphate cement to seal pits and fissures.
1905	W.D. Miller used silver nitrate for fissure restoration.
1920	Black suggested the conversion of retentive fissures into non-retentive depressions on the occlusal surfaces of teeth to reduce plaque accumulation.
1923	T. P. Hyatt introduced prophylactic odontotomy technique, consisting of restoring the fissures with silver or oxyphosphate cement soon after the eruption of teeth in the oral cavity and later replacing it with amalgam after complete eruption.
1929	Bodecker proposed a technique of converting deep narrow fissures into self-cleansing fissures by performing enameloplasty (fissure eradication).
1939	Gore used polymers (cellulose nitrate in organic solvents) as fissure sealants.
1942	Klein and Knutson used ammoniacal silver nitrate to seal pits and fissures.
1950	Decrease in caries due to fluorides was noticed. But fluorides were found ineffective on occlusal surfaces.
1965	Development of Bis-GMA (Bisphenol A-Glycidyl Methacrylate) by Bowen at the National Bureau of Standards.
1967	First clinical trial by M.G. Buonocore and Cueto using cyanoacrylates as sealants
1968	Rodyhouse used Bis-GMA and MMA (Methyl Methacrylate) with peroxide amines as fissure sealants without etching enamel prior to its application. He reported a 30% decrease in fissure caries using this technique.
1970	Buonocore published his first paper describing the successful use of Bis- GMA resin with ultraviolet light as pit and fissure sealant.
1971	NuvaSeal was the first commercially available pit and fissure sealant.

CHAPTER 17

Vaccination in Children/Caries Vaccine

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Abstract: Vaccination is an important measure that is undertaken to provide an individual with acquired immunity against a variety of diseases which may result in significant morbidity and sometimes, may even result in mortality. The vaccination program undertaken by Government has helped in containing many diseases which were responsible for many fatalities in the past. Like any other branch of science, vaccines are also evolving with continuous advancements in their mode of synthesis as well as the method of delivery.

Even though various approaches to caries prevention are available, dental caries is still considered to be an irreversible, and a prevalent disease among humans mankind. *Mutans streptococci* are responsible for such activity. Biofilm is formed on the tooth surface due to everyday diet consumption followed by the role of mutans streptococci through the entry into biofilm on the tooth surface. Most treatment options or medications work for the disposal or destruction of this microorganism. The concept of immunization can be the alternative that works on either inactive or passive grounds. Certain molecular determinants of *mutans streptococci* are studied and considered for caries formation. Therefore, their use in the preparation of the caries vaccine is widely researched.

Keywords: Advancements, Caries Vaccine, Immunization, Mutans Streptococci, Vaccine.

INTRODUCTION

The term "vaccine" originated from the Latin words 'Variolae vaccines or cowpox. Edward Jenner was the first person to demonstrate the concept of vaccination in 1795 by injecting sera from cowpox to prevent chickenpox. A "Vaccine" may be defined as 'A biologically derived product that can provide

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adaptive immunization against a specific organism or disease'. Various routes of its administration are oral, intranasal, or injectable routes [1].

Vaccines are of two types:

- Prophylactic vaccines- to prevent disease
- Therapeutic vaccines -used for treating disease

The etiologic agent for dental caries is *mutans streptococci*. There are various approaches for the prevention of dental caries such as fluorides, pit and fissure sealants, and synthetic and mechanical plaque removal agents.

Dental caries like other diseases occurs on tooth surfaces that are covered by saliva in which antibody immunoglobulin secretory IgA (SIgA) is present. Therefore, immunization procedures using salivary SIgA antibodies help to induce caries immunity. Salivary IgA antibodies have the potential to inhibit the accumulation of *mutans streptococci* on the teeth.

VACCINES FOR CHILDREN

Classification of Vaccines

a. Live-attenuated vaccines: Mumps, measles, rubella, and Varicella zoster.
b. Inactivated vaccine: Influenza, Hepatitis A, Pneumococcal polysaccharide.
c. Recombinant sub-unit: Hepatitis B.
d. Toxoids: Diphtheria; Tetanus.
e. Conjugated polysaccharides with protein: Hemophilus influenza, Meningococcus, Pneumococcus.

Constituents of a Vaccine

Vaccines contain therapeutic agents or drugs and are generally derived from either killed or attenuated forms of micro-organisms, toxins, or surface proteins. A vaccine is constituted of- an antigen, solvent (water or saline), additives, preservatives, and at times, adjuvants. All of these ingredients of a vaccine are collectively termed as 'excipients [2].

Preservatives: Preservatives ensure vaccine sterilization due to their shelf-life. These prevent container contamination and also aid in protecting from microbiological contamination. These are non-toxic in quantities used and do not diminish their potency. The most commonly used preservatives in various kinds of vaccines are as follows:

- Phenol: It is used in vaccines against typhoid and pneumococcus.
- Benzalkonium chloride: It is used in the Anthrax vaccine.
- 2-phenoxyethanol: It is a preservative used in inactivated polio vaccines.
- Thimerosal: It is effective against the influenza virus.

Adjuvants: These agents act by enhancing the immunological effects of the antigenic component in a vaccine. However, these do not act as antigens. The most commonly used adjuvants in vaccines are Aluminium salts. Vaccines that contain adjuvants show slightly higher adverse reactions such as pain at the site of injection, fever, and malaise. Examples of adjuvant containing vaccines are-Hepatitis A and B, DPT (Diphtheria, Pertussis, and Tetanus), HPV vaccine, Japanese encephalitis (all of these contain Aluminium salts as adjuvants) whereas for the H1N1 vaccine, an adjuvant used is MF59 which is an emulsion of oil in water.

Antigens: Antigens are those components of a microorganism or any vaccine that triggers the host's immunological response. These cause the production of antibodies. Sometimes, these vaccines can produce serious side effects or clinical outcomes.

VARIOUS VACCINES FOR CHILDREN

There are various vaccines used for various systemic diseases [3]. Vaccines for various medical conditions have been summarized along with their type and year and depicted in Table **1**.

Table 1. Summary of various vaccines used in routine immunization.

Name of the disease	Vaccine type	Year in which developed
Viral		
Smallpox	Live attenuated	1798
Rabies	a) Inactivated vaccine b) Inactivated form derived from cell culture	1885 1976
Yellow fever	Live attenuated	1932
Influenza	a) Inactivated vaccine b) Live attenuated	1936 2003
Polio	a) Inactivated vaccine b) Live attenuated	1955 1062
Mumps	a) Inactivated vaccine b) Live attenuated	1948 1967
Rubella	Live attenuated	1969
Varicella	Live attenuated	1974

CHAPTER 18

Post COVID-19: Changing Perspective of Pediatric Dentistry

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Abstract: Novel coronavirus disease (COVID-19) is one of the worst pandemics known to mankind. It affects people of all age groups. The children may present with milder symptoms and may also be asymptomatic. In the current scenario, pediatric dentists pose a high risk of the disease due to close contact with not just children but also with their parents. Additionally, the majority of pediatric dental procedures advocate the use of an air rotor that generates massive aerosol increasing the transmission risk by a manifold. This, necessitates a change in dental practice protocol to adapt to the new routine. It requires modification in behaviour management techniques, tele-triaging of patients, stringent infection control, minimization and replacement with minimally invasive techniques along with the use of adequate isolation.

Keywords: Coronavirus Disease, Children, Pandemic, Pediatric Dental Clinic, Tele Dentistry.

INTRODUCTION

The current pandemic of COVID 19 is a serious problem to mankind in terms of health and economy. The world is facing an unprecedented threat from the coronavirus (COVID-19). The World Health Organization (WHO) has characterized COVID-19 as a pandemic and the virus has now spread to several countries and territories [1]. The disease can get transmitted through direct contact with persons, touching surfaces contaminated with the virus or through respiratory droplets of an infected person. This virus can survive on surfaces for several hours, but simple disinfectants can kill it. Although cases of COVID-19 appear to be fewer among children, national responses to the pandemic had kept the children away from school and health services to prevent transmission and to reduce the impact of this epidemic.

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The disruption and closure of schools and health services around the world compromise the children's right to education and health facilities. Learning about COVID-19 is the only way to diminish fears and anxieties related to the disease.

What is COVID-19?

COVID-19 is a disease caused by a new coronavirus called SARC –CoV-2. On 31st December 2019, a cluster of pneumonia cases, caused by a newly identified β-coronavirus, was observed in Wuhan, China. This coronavirus was initially named the 2019-novel corona-virus (2019-nCoV) on 11 February 2020 by WHO. The World Health Organization officially named the disease corona-virus disease 2019 (COVID-19). The Chinese scientists rapidly isolated a SARS-CoV-2 from a patient within a short time and came up with genome sequencing of the SARS-CoV-2 [2, 3].

Virology (Table 1)

Table 1. Classification of Corona-viruses.

Name	Found in
Alpha coronaviruses	Bats, rodents, civets, and humans
Beta coronaviruses	Bats, rodents, civets, and humans
Gamma coronaviruses	Birds
Delta coronaviruses	Birds
Omicron	White-tailed deer

Coronaviruses (CoVs) comprise a large family of enveloped, single-stranded, zoonotic RNA viruses belonging to the family Coronaviridae, order Nidovirales. They can infect a variety of animals (including livestock, companion animals and birds), which can cause serious respiratory, enteric, cardiovascular, and neurologic diseases. In humans, CoVs mostly cause respiratory and gastrointestinal symptoms ranging from the common cold to more severe diseases such as bronchitis, pneumonia, severe acute respiratory distress syndrome (ARDS), coagulopathy, multi-organ failure and death [3].

It was found that the genome sequence of SARS-CoV-2 is 96.2% identical to a bat CoV RaTG13, whereas it shares 79.5% identity with ARS-CoV. Based on the virus genome (Fig. **1**) sequencing results and evolutionary analysis, the bat has been suspected as the natural host of virus origin, and SARS-CoV-2 might be transmitted from bats *via* unknown intermediate hosts to infect humans. It is clear now that SARS-CoV-2 could use angiotensin-converting enzyme2 (ACE2), the same receptor as SARS-CoV, to infect humans [3, 4].

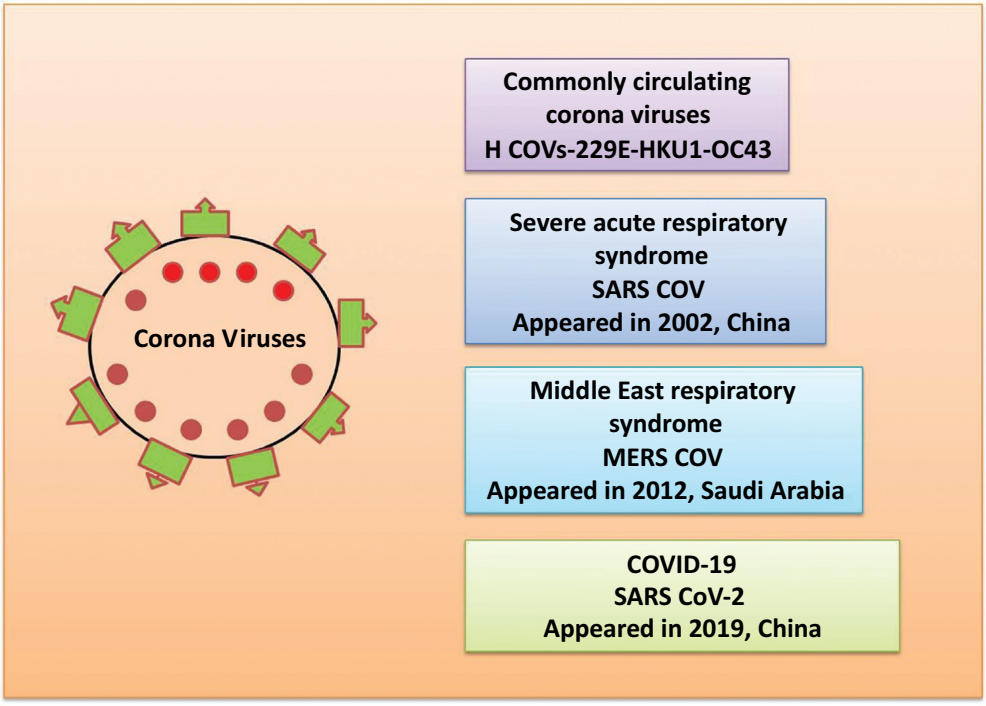

Fig (1). Summary of Corona-viruses disease.

Pathogenesis & Pathophysiology

COVID-19 infection is transmitted through:

- Large droplets generated during coughing and sneezing by symptomatic or asymptomatic patients
- Touching surfaces contaminated by the virus and then touching the nose, mouth, and eyes.
- Use of contaminated water *via* aerosolization
- Fecal-oral route is also postulated.
- As per current information, transplacental transmission from pregnant women to their fetuses has not been described. However, neonatal disease due to postnatal transmission is also a possible mode of transmission.
- Patients can be infectious for as long as the symptoms last and even during clinical recovery [5].

The virus can remain viable on surfaces for days in favourable atmospheric conditions but is destroyed in less than a minute by common disinfectants like

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Satyawan Damle

Professor Damle is a colossus giant, a celebrated teacher, distinguished leader, and policy-maker at several institutions and universities. He is the rare blend of a clinician and a scholar and has emerged with decades of teaching. He possesses more than 44 years of teaching experience. He was the Dean of Nair Hospital Dental College, Mumbai, for 13 years, also has been a postgraduate teacher for 30 years. He remained Director of Medical Education. He was the first Dental Surgeon promoted as Joint Municipal Commissioner, Medical Education. Prof. Damle is actively involved in research and has numerous publications in Indian and International journals.

Ritesh Kalaskar

Presently working as Professor and Head of the Department of Pediatric Dentistry at Government Dental College and Hospital Nagpur, Dr. Ritesh Kalaskar is a very well-known teacher and academician and has published nearly 70 scientific papers and 3 patents. Also, he is a recipient of the Best teacher award, awards for excellence in academics and research and a recipient of several Journals. He has been a member of organizing teams in various capacities to organize national and international conferences.

Dhanashree Sakhare

Dr. Dhanashree Sakhare has been enthusiastically involved in teaching and research activities with wide-ranging experience working in India at MM College of Dental Sciences & Research, Mullana. She was a lecturer of Orthodontics and then worked as an associate professor of Orthodontics & Dentofacial Orthopedics Currently, she is actively pursuing Australian Dental aspects and teaching aspirant overseas dentists in Australia. She has won best paper awards, delivered several lectures, and demonstrated clinical presentations at various Dental conferences. She has numerous publications to her credit.