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Dental Infetions in Children

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ABSTRACT

Infections are ubiquitous and affect one and all. Acquisition of oral microbial flora commences right from the time the child is born. Although most of these microorganisms are commensals in the oral cavity, some are pathogenic, while others are opportunistic pathogens. Certain microorganisms arise only after the development of specific ecological niches like the teeth. The most specific tooth born pathogen is Strep. mutans, which is responsible for the initiation of dental caries, while tissue borne micro-organisms like Actinomycetes contribute towards the development of periodontal infections. Apart from such bacterial infections, children are also exposed to fungal and viral infections during the course of their growth and development. By virtue of the constant changes occurring in the normal anatomical structures and the physiology, the route of spread of infection in children differs from that in an adult. Hence it is essential to understand the genesis of dental infections in children and establish a definite preventive and treatment regimen to combat these dental infections, as children are the future pillars of society.

KEYWORDS Oral cavity, Early Childhood Caries, Microorganisms, Medical Model, Surgical Model, Caries Vaccine.

ABREVIATIONS :
MS – Mutans Streptococci
CFU – Colony Forming Units
ECC - Early Childhood Caries
Strep – Streptococci
Peptostrep – Peptostreptococci

Children are considered to be the future pillars of society. But at the same time, it is these children who are most susceptible to diseases. The Oral Cavity offers the portal of entry to all nuisance-making agencies and the oral mucosa also presents a mirror reflecting the state of health or disease of the body. Hence, attention needs to be given to the pathologic changes in the oral cavity, before any attempt is made to restore health. Health [1] is defined as a state of dynamic equilibrium, where complete physical, mental and social well being of a person and not merely the absence of disease, exists. With respect to health, WHO had set a goal of "health for all by 2000 A.D."[2] This automatically includes the child population too.

The human body is constantly exposed to variety of microorganisms. These microorganisms may be pathogenic or non-pathogenic[3] Although most of these ubiquitous microorganisms are non-pathogenic, relatively a few are pathogenic and cause a variety of diseases in human beings, right from the fetal stage as there are certain microorganisms or agents which may cross the placental barrier at some stage or the other. This is the reason why the health of the mother is of prime importance. Needless to say, that the prenatal counseling of an expectant mother as regards health of both, is essential.

The initiation of the primary dentition occurs as early as sixth week of intra uterine life and the development of the permanent dentition continues till the age of 18 to 25 years post-natally[4]. The complete formation of a tooth is a systematic and well-planned series of deposition and calcification of the layers like Enamel, Dentine and Cementum over a certain specific period of time. Any disturbance during this period any form, by any agent brings about aberrations or defects in the structure (s) of the tooth/teeth.

The various defects which can be seen are in the form of Linear hypoplasia [5], Pitting of Enamel surface, Discoloration or Altered morphological structure may be due to a change in the homeostasis during severe systemic conditions like Mumps, Measles, Chicken-pox, jaundice or antibiotic therapy e.g. Tetracyclines[6]. However, defects in the teeth can also occur or develop and lead to complications, even after the completion of this systematic process and the main cause of this is microbial activity, which is manifested in the form of dental caries.

Acquisition of microbial flora into the oral cavity is a tissue dependant entity, meaning thereby the colonization of various microorganisms on different tissues as they develop or emerge into the oral cavity. The oral tissues function as various ecological niches (the occlusal and smooth surfaces of the teeth, the gingival sulcus, the oral mucosa, tongue etc.) and each niche harbors specific group(s) of microorganisms.

The commonest infectious condition seen in the oral cavity, worldwide is dental caries, followed by periodontal infections and other hard or soft tissue infections. A question that arises at this point is whether dental caries can be called as an infectious disease[7]. The answer is YES. It is also a transmissible one[8]! Various microorganisms, along with many other factors contribute towards the development of the disease condition and its pathological process fulfils the Koch's postulates [9] and hence, it is rightly termed as a multi-factorial and infectious disease. The transmissible nature of the disease has been proved by a direct relation between the Colony Forming Units (CFU) of Mutans Streptococci (MS) of mothers and that of their children [10]. Conversely, studies by Caufield have suggested that decreasing the mothers' level of MS may interfere with the acquisition of the microorganisms by their children. The maximum chances of the body to acquire the microorganisms with respect to dental caries is termed as the window of infectivity [11] and it ranges from 19 to 31 months for MS.

The acidogenic and aciduric nature of the various cariogenic microorganisms, their virulence and the magnitude of the other contributing factors are responsible for the nature and the degree of destruction of the tooth structure. Thus the carious lesion may be seen involving the Enamel, Dentine individually or Enamel, dentine and the dental pulp collectively, from either occlusal, buccal, lingual, or proximal surfaces. Caries may also be initiated in the cementum of exposed root surfaces. However, deciduous teeth usually do not develop root caries unless they are retained into adult life, when their roots become exposed and therefore vulnerable[12]. Hence researchers have labeled this caries process as a site specific one.

Infiltration of the cariogenic microorganisms directly, or their toxins into the pulp leads to inflammatory response and subsequently to various degenerative changes, leading to abscess formation and thus rendering the tooth non-vital. The localization or the spread of the infection into various facial spaces depends upon the resistance offered by the tissues or the body as a whole.

The route of spread of infection in a deciduous tooth [13] differs from that in a permanent tooth mainly due to morphological and anatomical differences existing between the primary and permanent teeth. Included in these are the differences in the morphology of the roots, the tortuosity of the canals and physiological root resorption, leading to the transportation of the apical foramen. The location of the developing permanent tooth bud in relation to the roots of the deciduous teeth makes it essential for every one of us to be well versed with the above mentioned differences in the routes of spread of infection. Unlike the permanent teeth, infection from the deciduous teeth usually tracks down to the bi-/tri-furcation area [rather than at the root apices as in permanent teeth] [14] from the floor of the pulp chamber because of its porous nature, presence of accessory canals and the absence of a root trunk (gum boil), causing damage to the developing permanent tooth bud. A defect developed because of this infection in the form of a hypoplasia is termed as Turner's Hypoplasia [15]. The other defects[16], which have been observed, as sequelae to such furcational infection are torso version, premature eruption with less than 1/3rd root formation, osteolysis, sequestration, crater like bone loss, and dilacerations. If such infections are not controlled in time, they may lead to severe complications like osteomyelitis or cysts like radicular cyst. Depending upon the area of infection, there is enlargement of the regional lymph nodes.

The major causes of these infections are now grouped in a condition called EARLY CHILDHOOD CARIES (ECC)[17]. This condition was initially known by many terminologies such as Nursing bottle caries, Baby bottle syndrome, Rampant caries etc., the terminology has been changed to ECC because of various etiological factors other than feeding [18]. e.g. single parents, low-income families, malnutrition, physical disabilities etc. In addition, surveys from China, Tanzania and Thailand [19] where bottle-feeding is rare, showed that this condition existed even in the absence of the bottle. Studies from Peru, South Afrcia and Australia [20] showed high incidence of ECC in malnourished children. In low birth weight children [21], or children with poor nutritional status, the pre- and post-natal environmental insults lead to increased susceptibility to ECC.

ECC is a rapidly progressing condition, wherein there is early involvement of the dental pulp, leading to the conditions mentioned earlier. Clinically, the progress of caries pattern from an innocuous looking, reversible white spot lesion to complete destruction of the tooth crown occurs within a very short period of time and unfortunately passes unnoticed even through the parents' vigil. If unfortunately, such a child has any kind of congenital valvular heart defects, the condition may get further complicated by the onset of infective endocarditis (IE) [22].

The microorganisms associated with the pathogenesis of infective endocarditis [23] are Streptococcus viridans, Staphylococci and Candida albicans. Most dental procedures as well as normal functions produce a transient bacteremia lasting upto 30 minutes after cessation of the procedure [24]. It has been a general consensus that dental procedures have an increased potential to induce IE in susceptible hearts. However, a recent cohort study has found no definitive link between IE and dental procedures, even with patients with valvular abnormalities [25]

Just as these microorganisms affect the hard tissues, a different a different group of microorganisms contribute towards the development of soft tissue infections in oral cavity. The commonest soft tissue infections seen in children and adolescents are Herpeticgingivostomatistis, ANUG, Localized Juvenile Periodontitis and Candidiasis.

In addition, systemic conditions[26] like Mumps, Measles, Rubella and HIV infection also exhibit the clinical oral manifestations at various stages of diseases. Therefore, serum derived antibodies in saliva, can now be used in dental office to quickly test for such an array of systemic diseases that strike children . Children who contact HIV infection through vertical transmission also exhibit clinical oral manifestations of systemic fungal, viral and bacterial infections[27]. Fungal infections can be managed by topical application of Nystatin rinses (1 lac units 4 times a day) and 0.12% chlorhexidinedigluconate .Systemically ,one can administer Ketoconazole 200/400 mg daily , or Fluconazole 100 mg daily . Viral infections [28] can be brought under control by administering Acyclovir 1-2 gm daily orally until the lesions clear. Bacterial infections in the oral cavity may be treated by aggressive curettage, chlorhexidine oral rinse, and possible antimicrobial therapy.

Management of dental infections and caries in particular , is based mainly on two models – Medical Model and Surgical Model[29]. Medical model is based on the principle of Primary Prevention. Before proceeding towards the surgical model, one may be required to prescribe anti-microbial treatment depending on the severity of infection, like mild ,moderate and severe. Antimicrobial treatment can be administered singly or in combination, depending on the nature of infectious microorganisms. Most dental and periodontal bacterial infections are caused by gram positive aerobes, facultative Streptococci and occasionally Staphylococci. Other occasional pathogens include anaerobic gram negative microorganisms such as Bacteriodes, Veillonella, Fusobacterium, gram negative aerobes and diptheroids (Cieslak, 1995). The initial drugs of choice continue to be penicillin and erythromycin. Streptococci, most Staphylococci and most anaerobic pathogens continue to remain sensitive to both penicillin and erythromycin . Owing to their bactericidal action, penicillin V (oral) and penicillin G (intra-muscular), usually recommended as the primary drug of choice for dental and periodontal infections. Erythromycin or clindamycin is usually the alternative drug of choice in patients allergic tp penicillin (Drug Information Handbook For Dentistry,1997) [30]

Surgical model in case of dental caries management deals with the eradication of the actual defect or diseased part, followed by its restoration with a suitable material, leading thereby to preservation of function and aesthetics. However, tooth restoration has no part whatsoever in disease prevention , but rather makes teeth more susceptible to dental caries by adding new ecologic sites where filling material interfaces with tooth surfaces and within which microorganisms being held at bay elsewhere in the mouth can begin to overgrow. Various procedures that come under the surgical approach are pediatric endodontics and the use of various restorative materials like Dental amalgam, composite resins ,and glass ionomers, alone or along with various Crowns like Stainless steel crowns, Polycarbonate crowns or Celluloid strip crowns.

Though dentistry today has advanced greatly to make use of such a wide range of treatment modality available, it is really unfortunate to note that dental treatment needs are usually neglected. Any kind of neglect ,either from parental or professional side would lead to premature loss of decicuous and/ or young permanent teeth resulting in the development of malocclusion, deleterious oral habit, poor esthetics, and finally loss of confidence.

After having had a critical look at both the models dental caries management,whichwhere aimed at eradication of the symptoms of the diseased condition, it is quite natural for anybody to think of the feasibility of a caries vaccine, on the lines of those that have been developed for other systemic conditions. Here comes the search for the magic bullet[31]. Although caries vaccine has been the holy grail of preventive dentistry for more than 50 years, and though research till now has been disappointing, it is closer to reality today with advances in the understanding of oral immune system. A few of the causes of disappointment about the active immunisation-[32]were :-

1) The oral vaccines were destroyed by bodily proteins and digestive enzymes
2) Application of DNA techniques to MS have confirmed that the various strains can be quite different from one another.
3) Scientific ethics dictate that no clinical trials of a vaccine developed from the whole or accentuated organisms will ever be conducted.

However , experiments in rats , by using a coupling of an antigen to a non-toxic subunit of cholera have proved to be effective in reducing the MS levels [33]

Advances in genetic engineering have steered the attention of the researchers to more promising passive immunization [34], by way of introducing specific targeted antibodies directly via toothpastes or mouthrinses or by incorporating into pacifiers. Addressing the precipitating cause, rather than symptoms would be the rational approach for not only the dentists, but also the paediatricians of today and in the near future.

Health is achieved only when the body , as a whole, can resist the attempts of the harmful environment agents to disrupt the equilibrium of the body. To accomplish good immunity ,body requires good nourishment; but for the consumption of a balanced diet, the health of the oral tissues is of paramount interest and hence important, though generally more attention is paid to the other systems, while neglecting the mirror of the body i.e. the mouth. However, in reality, THE MOUTH SAYS A LOT[35]

In summation, the mirror of the complete body, i.e. the oral cavity ,if not given proper attention , will contribute to loss of body's resistance and thus predispose the child to various infectious diseases, for the eradication of which, all of us should strive.

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