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Zirconia Crowns in Pediatric Dentistry: A Review

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ABSTRACT:

Children who lose their front teeth may experience a range of complications, including difficulties with speech, impaired aesthetics, decreased masticatory efficiency, the emergence of parafunctional habits, and psychological issues. In response to growing awareness of aesthetic dental options, there is an increasing demand for effective treatments for dental caries, discolored teeth, hypoplastic abnormalities, fractures, and missing teeth in pediatric patients. For full crown coverage, various restoration options are available, including Figaro crowns, zirconia crowns, open-faced stainless steel crowns (SSC) with veneer on the chair side, polycarbonate crowns, and commercially veneered SSC.
This article provides an overview of zirconia crowns in pediatric dentistry, highlighting their properties, clinical applications, and advantages over other restorative options.

1. Introduction

Establishing and maintaining good oral health during infancy and early childhood creates a foundation for good oral health in later life. Dental caries is a highly prevalent disease, especially among young children. According to data from the World Health Organization, dental caries has a negative impact on up to 90% of schoolchildren in developing nations.[1]
The early loss of primary teeth can lead to a decrease in vertical dimension, reduced masticatory efficiency, the development of parafunctional habits (such as tongue thrusting and speech problems), aesthetic and functional issues like malocclusion, and psychological problems that may affect the child's personality and behavioral development.[2,3] Therefore, maintaining the primary dentition in a healthy condition is crucial for the child's overall well-being.
SSCs were introduced to pediatric dentistry by the Rocky Mountain Company in 1947, first described by Engel and later popularized by Humphrey in 1950. For over seven decades, SSCs have proven to be more durable and long-lasting compared to materials like amalgam and composite[4]. However, despite these advantages, SSCs have a significant drawback: their metallic appearance, which has been poorly received by patients, parents, and practitioners.[5]
Aesthetics is the science of beauty - that detail of an animate or inanimate object that makes it appealing to the eye. There have been several aesthetic treatment modalities which have been used to treat carious lesions in the primary teeth in very young children. Recently, there has been an increasing demand from parents for aesthetic restorations led to the introduction of pre-veneered SSCwith resin facing.This breakthrough led to the introduction of various aesthetic crowns like Strip crowns, Polycarbonate crowns, Cheng crowns, Pedo Jacket crowns, New Millennial crowns, and the latest being the zirconia crown and Figaro crowns into the clinical practice.These crowns not only enhance the child's appearance but also their self-esteem, speech, and phonetics.The parental satisfaction is also greater with these crowns. This review intends to highlight on all the aesthetic crowns used in pediatric dentistry along with their recent advances.

Zirconia Crowns

The name “Zirconium” comes from an Arabic word “Zargon” which means “golden in colour.” Zirconium dioxide (ZrO2) was accidentally identified by German chemist Martin Heinrich Klaproth in 1789 while he was working with certain procedures that involved the heating of some gems. Subsequently, Zirconium dioxide was used as rare pigment for a long time. It was the impure zirconium that was used as pigment. In late sixties the research and development of zirconium as biomaterials was refined.[6]pure zirconia has a monoclinic structure at room temperature, which is stable up to 1170°C. Between this temperature and 2370°C, tetragonal zirconia is formed, while cubic zirconia is formed at temperatures above 2370°C. After processing, and depending on the cooling process, the tetragonal phase becomes monoclinic at about 970°C. The transformation of the tetragonal to monoclinic phases can be employed to improve the mechanical properties of Zirconia, especially its tenacity.[7]Different oxides, such as Yttrium Oxide (Y2O3), Calcium Oxide (Cao) or Magnesium Oxide (MgO), can be added to Zirconia to stabilize it, allowing the tetragonal form to exist at room temperature after sintering.[8]
If smaller amounts are added, 3 wt% to 5 wt%, a partially stabilized zirconia is produced. The tetragonal zirconia phase is stabilized, but under stress, the phase may change to monoclinic, with a subsequent 3% volumetric size increase. This dimensional change takes energy away from the crack and can stop it in its tracks. This is “transformation toughening.”
Also, the volume change creates compressive stress around the particle, which further inhibits crack growth.[9]

Ready-made primary Zirconia Crowns available for restoration of primary incisors and molars are directly bonded onto the tooth. The various commercially available preformed Zirconia crowns are:

Nusmile ZR[10]

These crowns are made from high grade monolithic zirconia ceramic, with looks like the natural teeth and a material strength 9 times stronger than natural teeth. These are easy to place and offer superior durability to last until the tooth exfoliates without needing any ongoing repairs. The translucency of zirconia ceramic has been optimized for both natural aaesthetics and to prevent the problem of dark tooth show through of pulpally treated teeth. Maxillary central incisors are fabricated as right and left and are available in size range of 0-6, Lower incisors are fabricated in a universal style.Posterior crowns are fabricated as right and left, upper and lower with 1st Primary Molars available in Regular or Narrow. It is available in 3 shades i.e., Pedo1, Pedo3, Pedo4.

Ez Pedo[11]

EZ PEDO is the first to introduce the monolithic zirconia crowns for children, monolithic zirconia eliminates the problem of chipping and fractured surfaces, these crowns are made with Zir lock technology, which increases the internal surface area and thus maximizing the retention, these crowns have glazed facial surface and non-glazed occlusal surface thus providing aesthetics with minimum wear. These crowns can be easily autoclaved without causing any change in colour or structural integrity.

These crowns are available for both anterior and posterior teeth, with maxillary incisors and canines available for right and left side with a size range of 1-6, and mandibular incisor in universal size in a size range of 1-4. For 1st and 2ndmolar options available are max/mandi, L/R with size range 2-7.

Zirconia Kinder Krowns[12]

These crowns are made from raw materials of TOSOH Corporation, Japan, which is the world market leader for zirconium dioxides made using the latest hydrolysis processes and nano technologies, these crowns are with a microscopically scratch free surface which minimizes wear on the opposing. The crowns for anterior teeth are available in universal contour or for right and left side, in two options for length as regular or short and in two shades i.e., pedo1 and pedo2, with a size option of range 1-6. The posterior crowns are available for both 1st and 2nd molars and available in regular and mid sizes with both shades pedo1 and pedo2.

Cheng Crowns Zirconia[13]

These crowns are made from monolithic zirconia and are biocompatible, autoclavable, and more durable than natural enamel. The zirconia and the sintering process used gives these crowns the highest flexural strength rating of any paediatric crown and with moderate translucency, these crowns have slim facial surface, thin walls, and low mesio-distal arches. These qualities ensure minimal tooth preparation for a better fit. These crowns come with gradient shading providing natural tooth colour, these are the only pre-crimped zirconia crowns available on the market, the crimped margins give a more natural emergence profile along with retention. These crowns are available for both anterior and posterior teeth, with a size range of 1-6 for anterior and 1-7 for posteriors.

Kid-E-Crowns [14]

Kid-E-Crowns is a pediatric dentistry company that offers anatomically shaped zirconia crowns for both anterior and posterior teeth. These crowns provide comprehensive coverage for various dental needs and are pre-formed, reducing chair time and making the procedure quicker and more comfortable. The crowns mimic the natural appearance of teeth, providing an aesthetically pleasing result. Made from high-quality zirconia, they are durable and resistant to wear, making them suitable for children's active lifestyles. The biocompatible zirconia reduces allergic reactions and ensures safety. With proper care and regular dental check-ups, Kid-E-Crowns zirconia crowns can last for years, providing a long-term solution for restoring decayed or damaged primary teeth.

Advantages

1. superior aesthetics and natural appearance.
2. short chair time.
3. Highly durable.
4. High strength.

Disadvantages

1. Zirconia can cause occlusal wear to the antagonist tooth.
2. These crowns are non crimpable.

2. Conclusion

Aesthetic dentistry focuses on function and beauty with the values and the individual needs of the patient involving an attitude, artistic ability, intuition and technical competence, aesthetic dentistry can provide the beautiful smile that both parents and children desire. The Pediatric dentists have the responsibility and ability to create beautiful smile for young patients. The advent of such techniques, devices and material helps in creating beautiful restorations which help children and adolescents improve their self image as we know that the child aesthetics is the guide to the adult aesthetics.

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