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Review Article

Stainless Steel Crown: A Comprehensive Review.

Navpreet Thakur*[1], Darshdeep Kaur[2], Ramandeep Kaur Mutti[3]

1. BDS, National Dental College and Hospital, Derabassi, Punjba, India.

2. BDS, Dasmesh Institute of Research and Dental Sciences, Faridkot, Punjab, India.

3. BDS, Desh Bhagat Dental College and Hospital, Muktsar, Punjab, India.

***Correspondence to**: Navpreet Thakur, BDS, National Dental College and Hospital, Derabassi, Punjba, India.

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ABSTRACT

Stainless steel crowns (SSCs) are widely utilized in pediatric dentistry for the restoration of primary molars affected by caries, trauma, or developmental defects. This comprehensive review evaluates the clinical effectiveness, longevity, and application of SSCs in treating children. By analyzing recent studies, we highlight their advantages such as durability, biocompatibility, and ease of placement compared to other materials. Furthermore, we discuss potential complications and patient satisfaction, emphasizing the vital role of SSCs in fostering optimal oral health in pediatric patients. The findings underscore SSCs as a reliable and practical choice for dental restoration, warranting their continued use and further exploration in clinical protocols.

Keywords*: Stainless Steel Crowns, SSC, Primary teeth.*

Introduction

Pediatric dentistry addresses the unique oral health needs of children, focusing on prevention, diagnosis, and treatment of dental issues. Among these issues, dental caries in primary molars represents a significant public health concern, with high prevalence rates leading to the necessity for effective restorative solutions. Primary teeth are crucial not only for mastication but also for proper arch development, space maintenance, and guiding the eruption of permanent successors. Consequently, preserving the integrity of these teeth is essential for the overall health and development of a child.[1]

Stainless steel crowns have become a standard restorative option in pediatric dentistry due to their exceptional attributes. First introduced in the 1950s, SSCs offer durability and strength, making them ideal for the high occlusal forces encountered in primary molar regions. These crowns can effectively manage extensive carious lesions, structural defects, or traumatic injuries, providing a reliable option for long-term restoration.[2]

Several factors contribute to the widespread acceptance of SSCs:[1,2]

Durability: SSCs are fabricated from stainless steel, providing resilience against wear and tensile strength, ensuring they withstand the rigorous demands of children's biting and chewing.

Biocompatibility: Their material composition minimizes the risk of adverse reactions, promoting a favorable intraoral environment for both hard and soft tissues.

Ease of Application: SSCs can be quickly and accurately placed in pediatric settings, offering efficiency that

is essential given the variable cooperation levels of young patients.

In addition to their mechanical and biological advantages, studies have demonstrated that SSCs offer superior clinical performance compared to alternative restorative materials, particularly in terms of survival rates and reduced failure incidents. Despite their benefits, some practitioners face challenges related to patient acceptance, perceived aesthetics, and parental preferences regarding treatment options.[3,4]

This review aims to synthesize current literature on SSCs, focusing on their indications, material properties, clinical outcomes, and patient satisfaction. By providing a comprehensive overview, this review seeks to reinforce the importance of SSCs in pediatric restorative practice and to guide clinicians in making informed decisions about treatment modalities for their young patients **(Table 1, 2).** Ultimately, the continued advancement and application of SSCs will contribute significantly to enhancing pediatric dental care.

Table 1: Characteristics of Stainless Steel Crown[3]

Feature	**Description**
Durability	High
Cost-effectiveness	High
Full crown coverage	Yes
Caries prevention	Excellent
Aesthetic	Limited
Risk of hypersensitivity (nickel)	Yes
Postoperative discomfort	Moderate
Indications	Pulp-treated teeth, children with dental defects, etc.
Complications	Potential for microleakage, gingival inflammation

Table 2: Composition of Stainless Steel Crowns[4]

Content	**Percentage**
Chromium	17-19%
Nickel	9-13%
Iron	67%
Minor element (Carbon, Silicon, manganese	4%

Indications[5,6]

1. After pulp therapy (Pulpotomy/Pulpectomy)
2. Multi surface caries restoration
3. Developmental defect of tooth e.g. Amelogenesis imperfecta, Dentinogenesis imperfecta, enamel hypoplasia.
4. Fractured tooth
5. Wasting disease e.g. Bruxism
6. Weaken abutment of space maintainer

Contraindication[5,6]

1. Non-restorable tooth
2. Patient with nickel allergy
3. Tooth near to exfoliation

Advantage and Disadvantages of Stainless-steel crown:

Stainless steel crowns offers numerous advantages that make them a preferred choice in pediatric dentistry. Their notable durability allows them to withstand significant occlusal forces, making them ideal for primary molars that endure considerable wear during chewing. Additionally, SSCs are biocompatible, posing minimal risk of allergic reactions and ensuring the safety of surrounding tissues. The crowns are easy to place, requiring less time in a clinical setting and providing a quick solution for extensive dental restorations. Furthermore, SSCs have a proven track record of longevity, with studies indicating high survival rates and reduced failure compared to other materials. Their cost-effectiveness also makes them accessible for families and dental practices.[5-7]

However, SSCs are not without disadvantages. A primary concern is their aesthetic limitations; the metallic appearance may be unappealing to children and parents alike, potentially leading to dissatisfaction, especially in visible areas of the mouth. Additionally, SSCs require precise preparation and fitting, and if not properly placed, they may lead to complications such as discomfort or improper occlusion. Some patients may experience sensation or irritation due to the metal in the crown, which can contribute to anxiety during dental visits. Lastly, while SSCs are durable, they can occasionally fracture or loosen if subjected to excessive force, making regular follow-up appointments essential for monitoring their condition. Balancing these advantages and disadvantages is crucial for clinicians when considering the best restorative options for pediatric patients.[7-9]

Clinical procedure:

Crown selection- Before starting the tooth preparation crown can be selected by measuring the mesiodistal width of the tooth space with dividers or crown can be selected after the crown preparation by trial and error method. A correctly selected crown should cover the prepared crown completely and should resist it removal.[3]

Achieving anesthesia- it is necessary to avoid discomfort during tooth preparation and during crown adaptation.[3]

Occlusal Reduction- Occlusal reduction is done to provide space for adaptation of SSC. It should be done prior to proximal reduction to evade invisibility of preparation areas due to blood contamination. There should be at least 1 to 1.5 mm of space ideally to adapt stainless steel crown on tooth.[4,5] **(Table 3,4)**

Table 3: Occlusal reduction for primary tooth suggested by various Authors

Author	Recommendation
Humphrey (1950)7	Cups should be reduced if necessary
Mink and Bennet (1968)[8]	1–1.5 mm uniform reduction
Mathewson (1974)[9]	1-1.5 mm
Troutman and Kennedy (1976)[10]	1.5–2 mm
Rapp (1966)[11]	Preparation height 4 mm from gingival margin

Proximal Reduction- Proximally, tooth reduction is made through the mesial and distal contact areas using fine, long, tapered diamond bur, held slightly proximal reduction should extend below gingival margin to avoid ledge formation. Precaution should be taken to avoid damage to adjacent tooth while proximal preparation.[3]

Buccal and Lingual Reduction- Minimal or no reduction requires for buccal or lingual surfaces as it aid in retention because of undercuts. Buccal reduction requires especially for buccal bulge of the first primary molar.[3]

Crown adaptation- Although SSC are prefabricated but most of the crown requires contouring and crimping to achieve tight fitting of crown. Contouring involves inward bending of the gingival third of the crown margin to restore anatomic features of the natural crown and to reduce marginal circumference to achieve good fitting. Crimping involves inward banding of crown periphery 0.5- 1 mm with the help of #800-417 crimping plier.[3]

Crown cementation- Glass ionomer cement or polycaboxylate cement are most commonly used for cementation. Fill 2/3rd of inner aspect of the crown with cement. Excess cement should be removed with help

of the floss.[3]

Table 4: Modification Of Stainless Steel Crown	
Author	**Modification**
Nash (1981)[12]	Multiple crowns can be placed in same visit. When multiple crowns are to be placed in the same quadrant, the adjacent proximal surfaces of the teeth being prepared should be reduced slightly more than usual.
McEvoy (1977)[13]	**Adjacent stainless steel crown with arch length loss:** proximal space loss flattening of contacts of SSC done with straight Howe pliers.
Mink &Hill (1971)14	**Oversized crown or undersized tooth:** The undersized tooth or the oversized crown commonly occurs due to a longstanding interproximal caries. To reduce the crown of circumference, a V cut is made on the buccal surface of crown. The cut edges of crown are re-approximated to reduce crown circumference.
	Under sized crown: If crown is undersized, then crown may be cut on the buccal or lingual surface, additional piece of 0.004 inch stainless steel band material may be welded into place to increase the crown circumference.
	Open contact: it can be managed by selecting a larger crown or exaggerated interproximal contour by using a #112 ball and socket.
	Deep subgingival caries: managed by soldering an extension of steel band material
Croll (1980)[15]	**Restoration of bruxism:** This condition causes excessive occlusal wear, which results into decreased vertical height. In such condition occlusion can be increased by the addition of a layer of solder from the inner surface of crown
Hartmnn (1983)[16]	**Open faced SSC:** to improve appearance of anterior SSC labial surface trimmed away to leave a crown perimeter, which is then restored with a resin veneering with composite

Complication: Various complications can occurs while crown preparation and adaptation of stainless steel crown.[17,18] **(Table 5)**

Table 5: Various Complication of SSC	
Complication	**Reason**
Crown tilt	Over preparation of crown can result into crown tilt
Interproximal ledge	Ledge formed due to improper sub-gingival preparation that interfere with seating of crown
Over extension of the crown	Over extension of crown appear as gingival blanching; which can leads to loss periodontal apparatus problems due to food lodgement.
Ingestion/inhalation of crown:	Accidental ingestion of crown can occur due to uncooperative behavior of child or negligence from dentist.
Poor margins	When the crown is poorly adapted, its marginal integrity is reduced which results in increase plaque retention and subsequent gingivitis increases with marginal discrepancy.

Parental Acceptance of Stainless Steel Crowns:

Parental acceptance of stainless steel crowns (SSCs) in pediatric dentistry has evolved in recent years, shaped by various factors such as awareness of the crowns' benefits, aesthetic preferences, and educational outreach from dental professionals. SSCs are commonly used to restore decayed or damaged teeth in children, largely due to their durability, affordability, and effectiveness. However, as dental technology advances, the future perspective of SSCs is increasingly influenced by the desire for improved aesthetics and ongoing research into their long-term benefits.

Current Landscape of Parental Acceptance:

The current acceptance of SSCs among parents can be attributed primarily to their proven functionality. These crowns are designed to withstand the heavy forces of chewing in children's mouths, making them a reliable option for restoring teeth affected by decay or trauma. Parents often appreciate that SSCs can last several years, reducing the need for replacement and minimizing the risk of further dental issues. The cost-effectiveness of stainless steel crowns also plays a significant role in parental decisions. Compared to other restorative materials, SSCs are generally more affordable, making them a practical choice for many families. Moreover, SSCs require less tooth structure to be removed than other crown types, such as porcelain-fused-to-metal crowns. This minimally invasive approach leads to less anxiety for both parents and children, as it

results in shorter procedures and less discomfort. Evidence-based research supports the efficacy of SSCs, with studies demonstrating high success rates in terms of functionality and durability. As such, parents are often reassured by the extensive clinical evidence that supports the use of stainless steel crowns in pediatric dentistry.[19,20]

Aesthetic Concerns:

Despite the advantages of stainless steel crowns, aesthetic concerns remain a barrier to wider parental acceptance. Many parents worry about the metallic appearance of SSCs, especially when the crowns are placed on visible teeth. Children, particularly those in school, might feel self-conscious or embarrassed about having a noticeable metal restoration. This concern has led some parents to explore alternative options, such as tooth-colored composite restorations or zirconia crowns, which are perceived as more aesthetically pleasing. However, these alternatives may not always provide the same level of durability or cost-efficiency as SSCs. [19,20]

Future Perspectives:

Looking toward the future, there are several promising avenues to enhance parental acceptance of stainless steel crowns. One significant area of development is the advancement of materials used in dental restorations. Researchers are working on creating stainless steel crowns that incorporate aesthetic elements, such as coatings that can mimic the appearance of natural tooth enamel. These innovations could address the aesthetic concerns parents have while retaining the functional benefits that SSCs provide.

Educational outreach is another critical area for improving acceptance. Dental professionals can play a pivotal role in informing parents about the long-term benefits of SSCs, emphasizing their reliability and durability. Clear communication about the potential risks and benefits of various crown options can empower parents to make informed decisions. Utilizing visual aids and demonstrations in the dental office can also help alleviate concerns by showcasing the functionality of stainless steel crowns in a child's dental care plan.

Additionally, longitudinal studies that monitor the performance and success rates of SSCs over time can underscore their value in pediatric dentistry. The more evidence that supports the advantages of SSCs, the more likely parents are to embrace them as a viable solution for their children's dental needs. Parents often seek evidence-based assurances, and continued research can bolster their confidence in the longevity and effectiveness of stainless steel crowns.

Engaging parents in the decision-making process is essential for fostering acceptance. By involving parents in conversations about their child's treatment options, dentists can create a collaborative environment that encourages questions and addresses concerns. This shared decision-making approach not only builds trust but

also empowers parents to feel responsible for their child's dental health, increasing the likelihood that they will accept SSCs as a treatment.

Finally, as the demand for aesthetic and functional restorations continues to grow, the dental profession will likely see an increase in innovative solutions that balance the best of both worlds. The emergence of hybrid materials that provide the strength of stainless steel with the aesthetic qualities desirable to parents can significantly change the landscape of pediatric dental restorations.

Conclusion

Stainless steel crowns are indispensable in pediatric dentistry, providing lasting restorations and functional solutions for young patients with compromised primary teeth. Their durability, protective qualities, and effectiveness in managing various dental issues solidify their role in maintaining oral health in children. Future research could further enhance the materials and techniques involved, increasing acceptance and esthetic options in pediatric restorative dentistry. Through ongoing evaluations and updates in clinical practice, dentally-related challenges in children can be effectively mitigated, paving the way for healthier adults.

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