Pediatric Preformed Metal Crowns - An Update

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Abstract
Stainless Steel crowns (SSC) were introduced in 1947 by the Rocky Mountain Company and popularized by Humphrey in 1950. Prefabricated SSC can be adapted to individual primary teeth and cemented in place to provide a definitive restoration. The SSC is extremely durable, relatively inexpensive, subject to minimal technique sensitivity during placement, and offers the advantage of full coronal coverage. SSC are often used to restore primary and permanent teeth in children and adolescents where intracoronal restorations would otherwise fail. This article brings the update of this definitive restoration.

Key words: Stainless steel Crown, Primary Teeth, Pulpectomy.

Introduction
Prevalence of dental caries in children in developed countries has been reducing since the early 1970s. However, this decline has now reached a plateau and there is clear evidence that treatment of caries in the primary dentition is still an integral part of child healthcare.

In the last century, different techniques and materials became available for the restoration of primary teeth. In the past, stainless steel crowns (SSCs) have been shown to provide the most durable restorative material for primary molars. However, they have been mainly recommended where pulp therapy has been performed, or in teeth with multi-surface restorations due to developmental defects or caries, or where other restorative materials are likely to fail.

When to use
Stainless steel crowns are the restoration of choice in the following situations:
1. Restoration of carious primary molars where more than two surfaces are affected.
2. Following pulpotomy or pulpectomy procedures.
3. Restoration of primary molars affected by localized or generalized developmental problems, e.g. enamel hypoplasia, amelogenesis imperfecta, dentinogenesis imperfecta.
4. Restoration of fractured primary molars.
5. Restoration and protection of teeth exhibiting extensive tooth surface loss due to attrition, abrasion or erosion.
6. In patients with a high caries susceptibility.
7. As an abutment for certain appliances, such as space maintainers.
8. In patients where routine oral hygiene measures are impaired, like mentally retarded patients
9. In patients undergoing restorative care under general anesthesia, if two or more surfaces are involved.

When not to use
1. In a patient with a known nickel allergy or sensitivity
2. Patient is unable to cooperate with treatment.
3. Primary tooth is approaching exfoliation, on radiograph half of the primary tooth root is resorbed

Composition of stainless steel crowns
SSC crowns are popularly known as nickel based crowns and their composition is Nickel: 76%, Chromium: 15%, Iron: 8%, Carbon: 0.08%, Manganese: 0.35%, Silicon: 0.2%

Different types of stainless steel crowns based on shape
The following are the different types of stainless steel crowns

Untrimmed crowns
• The untrimmed crowns are neither trimmed nor contoured.
• They require lot of adaptation and this are time consuming.
• Example of untrimmed crowns is Rocky mountain.

Pretrimmed crowns
• The pretrimmed crowns have straight, non-contoured sides but are festooned to follow a line parallel to the gingival crest.
• They still require contouring and some trimming.
• Examples of pretrimmed crowns are Unitek, 3M Co., st. paul, MN

Precontoured crowns
• The precontoured crowns are festooned and are also precontoured though a minimal amount of festooning and trimming may be necessary.
• Examples of precontoured crowns include Ni-Chromium
crows and Unitek stainless steel crows, 3M Co., st.paul,Mn.

**Types of stainless steel crowns available commercially**

**Rocky mountain**
- It is not prefestooned and requires trimmining at the gingival margins
- Occlusal table is small buccolingually so not stable and dislodged easily

**Ormco Company**
- It is prefestooned with broader occlusal table and long gingival height
- Will provide excellent restoration if properly belled and trimmed

**Unitek**
- It is variant of rocky mountain and ormco company
- Have broader occlusal table buccolingually and more stable

**3M Company**
- It is nickel based crown
- Height is similar to pretrimmed crown and are precontoured making them rounded
- Easy to fit and requires least amount of additional crimping, trimming and contouring.

**Instruments and Equipments used**

- **Burs**
  - Round - for caries removal
  - Flame shaped diamond bur - for occlusal reduction
  - Long thin taped diamond bur - for proximal, buccal and lingual reduction
  - Rubber wheel or point/green stone - for finishing and polishing

- **Pliers**
  - Johnson no 114 Contouring - for general contouring in the occlusal and middle region
  - No 417 Crimping plier - to produce marked curvature in cervical region
  - No 137 Gordon - for general contouring and shaping

**Clinical procedure**

**Crown selection**

The selected crown should restore the contact area and occlusal alignment of the prepared tooth. The crown selection can be done by trial and error or by measuring the mesiodistal width of the tooth space with dividers. It can also be helpful to measure the dimensions of the contralateral tooth. A correctly fitting crown should snap or click into place at try in.

Irrespective of whether the tooth to be restored is vital or non-vital, local anesthesia should be used when placing a stainless steel crown because of the soft-tissue manipulation. Rubber dam, although sometimes difficult to place in the broken down dentition, should be used where possible.

1. Restore the tooth using a glass ionomer cement or compomer prior to preparation for the stainless steel crown.

2. Reduce the occlusal surface by about 1.5 mm using a no 247 flame-shaped or tapered diamond bur. Uniform occlusal reduction will facilitate placement of the crown without interfering with the occlusion.

3. Using a fine, long, tapered diamond bur, held slightly convergent to the long-axis of the tooth, and cut interproximal slices mesially and distally. The reduction should allow a probe to be passed through the contact area

4. Little buccolingual reduction is needed unless there is a prominent Carabelli’s cusp etc. However, such reduction should be kept to a minimum as these surfaces are important for retention.

5. An appropriate size of a precontoured crown is chosen by measuring the mesiodistal width.

6. A trial fit is carried out before cementation. It is important that the crown should sit no more than 1 mm subgingivally. If there is excessive blanching of the gingival tissues the length of the crown should be reduced using scissors or abrasive stone at the margins and should be smoothed with a white stone.

7. Cement the crown with GIC or polycarboxylate cement. If the crown has been built up before the placement of the crown, a glass ionomer luting cement may be used, otherwise a restorative GIC should be used. Care should be taken while holding the crown as it can be easily dropped during placement. Excess cement should be wiped away and a layer of petroleum jelly placed around the margins while the cement is setting.
Ordering Information
There are 48 crown sizes available for primary molar

| Crown Shape                  | No. of sizes | MD Width range available mm |
|------------------------------|--------------|-----------------------------|
| Upper 1st primary molars     | 2,3,4,5,6,7  | 7.2 to 9.2                  |
| Upper 2nd primary molars     | 2,3,4,5,6,7  | 9.2 to 11.2                 |
| Lower 1st primary molars     | 2,3,4,5,6,7  | 7.3 to 9.3                  |
| Lower 2nd primary molars     | 2,3,4,5,6,7  | 9.4 to 11.4                 |

Stainless steel crown modification
In 1971, Mink and Hill reported several ways of modifying the stainless steel crown when the crowns are either too large or too short.

Undersized tooth or the oversized crown
- This commonly occurs due to a long standing interproximal caries, space loss has occurred. To reduce the crown circumference, a cut is made up of the buccal surface to the occlusal surface.
- The cut edges are re-approximated to overlap one another making circumference smaller.
- The overlapped edges are then spot welded.
- The crown is polished with a rubber wheel and fine abrasives.

The oversized tooth or the undersized crown
- Separate the edges as needed and weld a piece of 0.004 inch orthodontic band material across the cut surface.
- After contouring, apply the solder to fill any microscopic deficiency in seal. Polish the soldered crown.

Deep subgingival caries
- If the subgingival caries occurs interproximally, the undestooned Rocky mountain crown will be deep enough to cover the preparation.
- Another method is to solder an extension on interproximal areas of the crown.

The open contact
- If the closed contact are (except for the primate space) is not established, it will result in food packing, increased plaque retention and subsequently gingivitis.
- This problem can be solved by selection of a larger crown or exaggerated interproximal contour can be obtained with a 112 (ball and socket) plier to establish a close contact.

Open faced stainless steel crowns
- The stainless steel crown can be modified in anterior teeth by a open faced stainless steel crown, which is simply a stainless steel crown with the labial surface trimmed away to leave a crown perimeter which is then restored with a resin veneering.
- This has two advantages which are mentioned below:
  - Esthetic are often improved
  - The tooth structure is accessible for pulp testing.
Complications of stainless steel crown\textsuperscript{2,4,10,11,13}

The following are the common complications that can arise with stainless steel crown preparation are:

1. **Interproximal ledge**
   - A ledge will be produced instead of a shoulder free interproximal slice, if the angulation of the tapered fissure bur is incorrect.
   - Failure to remove this ledge will result in difficulty in seating the crown.

2. **Crown tilt**
   - Complete lingual or buccal wall may be destructed by caries or improper use of cutting instrument and this may result in finished crown tilting toward the deficient side.
   - Placement of restoration prior to crowing provides a support to prevent crown tilt, the alloy acting as a core.

3. **Poor margins**
   - When the crown is poorly adapted, its marginal integrity is reduced.
   - Recurrent caries may occur around open margins.
   - Chances of plaque retention and subsequent gingivitis increases with marginal discrepancy.

4. **Inhalation or ingestion of crown**
   - The presence of cough reflex in the conscious child will reduce the chances of inhalation and ingestion of the crown is more likely.
   - To prevent such mishaps, the rubber dam should remain in place until cementation.
   - If this occurs, attempt can be made to remove the crown by holding the child upside down as soon as possible.
   - If this is unsuccessful, medical referral should be done for an immediate chest radiograph
   - If the crown is in bronchi or lung, medical consultation will probably result in an attempt to remove it by bronchoscopy.

**Summary\textsuperscript{14,15}**

The literature discussing SSCs comes from clinical data. All indications for the use of stainless steel crowns up to date are listed, different makes of SSC, basic techniques as well as the problems of tooth size, retention, and the advantages have been highlighted. It would be very difficult to justify restoring a primary molar requiring a large multisurface restoration with an alternative material or leaving it untreated to be compared with longevity of primary molars restored with SSCs. All available evidence suggests that SSCs should continue to be used to restore primary molar teeth. The stainless steel crown enjoys a wide range of use in clinical pedodontics and will continue to be an asset in the management of the primary and permanent teeth in young children.

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