Stainless Steel Crowns

St. Barnabas Hospital

Caries Risk Factors

- Dental anomalies
- Systemic risk factors
- Sociodemographic risk factors
- Age of patient/behavior
- Dental age
- Site of the lesion
- Level of risk and disease activity
- Ability to recall on timely basis
- Previous caries experience
  - New caries
  - Recurrent decay

High Caries Risk

- dmfs greater than the child’s age
- Development of 2 or more lesions in one year
- Numerous white spot lesions
- High titers of Strep mutans
- Low socioeconomic status
- Parents, caregiver, sibling with high caries rate
- Appliance in the mouth
- History of high frequency of sugar consumption
  
  Tinanoff and Douglass 2001

Stainless Steel Crowns

- Introduced by Humphrey in 1950
- Considered superior to multisurface amalgam restorations
- Longer clinical lifespan than 2 or 3 surface amalgam restorations
- Manufactured in different sizes as a metal shell with some preformed anatomy
- Trimmed and contoured as necessary to individual teeth
- Durable, inexpensive, easily and quickly placed

Stainless Steel Crowns - Alloy

- Chrome Steel: (18-8 alloy)
  - 18% chromium
  - 8% Nickel
  - Carbon content 0.8-20%
- Nickel-Chrome (Ion crowns, 3M)
  - 77% Nickel
  - 15% Chromium
  - 7% Iron

Properties

- Heating does not increase strength
- Work hardens
- High chromium reduces corrosion
- Soldering with flux reduces corrosion resistance
Indications (AAPD)

- Primary or permanent teeth with extensive carious lesions
  - Primary teeth that have caries on 3 or more surfaces
  - Caries that extends beyond the anatomic line angles
  - Primary first molars with mesial interproximal lesions because the morphologic appearance of the tooth results in inadequate support for mesial interproximal restoration
- Failure of other available materials
- Hypoplastic or hypocalcified teeth
- Following pulpotomy or pulpectomy
- Primary tooth to be used as an abutment for space maintainer
- Intermediate restoration of traumatized teeth
- Teeth with hereditary anomalies such as dentinogenesis imperfecta or amelogenesis imperfecta
- Restorations in disabled persons or others in whom oral hygiene is extremely poor and failure of other materials is likely

Not indicated when...

- Inability to fit one
  - Amount of tooth structure remaining
  - Ability of patient to cooperate with the treatment
- Teeth approaching exfoliation within 6-12 months should not be fitted

Objectives (AAPD)

- To restore form and function
- Maintain vitality where possible

Success Rates

Comparison with Class II Amalgams

<table>
<thead>
<tr>
<th>Predicted time to failure (years)</th>
<th>Age&lt;4 years</th>
<th>Age&gt;4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amalgam</td>
<td>SSC</td>
<td>Amalgam</td>
</tr>
<tr>
<td>1</td>
<td>17%</td>
<td>8%</td>
</tr>
<tr>
<td>5</td>
<td>49%</td>
<td>24%</td>
</tr>
<tr>
<td>10</td>
<td>69%</td>
<td>36%</td>
</tr>
</tbody>
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Crowns placed in children 4 years old and younger have a success rate approximately twice that of amalgam for each year up to 10 years of service.
This trend also apparent in children older than 4 years old.
Overall success rate 88%.
MST if placed <4 years old was 68 months.

Meta-analysis of SSC vs. Amalgam in Primary Teeth (Randall et al.)

- Failure rates of SSCs 1.9-30.3%
- Failure rates of amalgams 11.6-88.7%
- 1.5-9 failed amalgam for each failed SSC

Cost Effectiveness

SSC vs. Class II

- Most important function of primary molar is to maintain space
- Cost comparison must include cost of space maintainer
- After loss of SSC, doctor will often recement the same SSC (at no cost)
- The restoration of choice after a class II is the SSC

Seale 2002
Types of SSC

- Pre-trimmed crowns (Unitek, 3M)
  - Straight, noncontoured sides
  - Festooned to follow a line parallel to the gingival crest
  - Require contouring and trimming

- Precontoured crowns (Ni-Chro, 3M)
  - Festooned and precontoured
  - Some trimming and contouring may be necessary but usually minimal
  - If trimming is necessary the precontour is lost and the crown fits more loosely than before trimming

Preparation and Placement

- Note the preop occlusion
- Administer local anesthesia (lingual or palatal as well as buccal/facial)
- Rubber dam placement
- (Establish access with 330 or 169 in high speed, remove decay with large round bur in slow speed or spoon excavator - Pinkham)

Preparation and Placement

- Occlusal reduction
  - 169L or football in high speed
  - 1.0 - 1.5 mm or until out of occlusion with adjacent tooth in contact
  - Maintain occlusal incline of crown

- Proximal reduction
  - Taper fissure bur or thin tapered diamond
  - Bur held parallel to long axis of tooth
  - Break contact gingivally, buccolingually - pass explorer through
  - Vertical walls with slight convergence in occlusal direction
  - Gingival proximal wall finish line should have a feather edge finish line

Preparation and Placement

- Selection of crowns as trial and error
- Goal
  - Place smallest crown that can be seated
  - Establish pre-existing proximal contacts

- Size 4 is most frequently used
- Seat lingual first and apply pressure in buccal direction
- Friction should be felt as crown slips over the buccal bulge
- Crown snap or click into place
- In between size - may need further tooth reduction or crown can be cut on lingual or buccal to increase size
- Patient might bite on stick or tongue depressor to help force crown over prep

Preparation and Placement

- After seating crown - establish preliminary occlusal relationship by comparing adjacent marginal ridge heights
- If crown does not seat to same level as the adjacent tooth:
  - The occlusal reduction may be inadequate
  - The crown may be too long
  - Bone level
  - Short proximal crown
  - Bumping
  - A gingival proximal ledge may exist
  - Contact may not have been broken with the adjacent tooth preventing complete seating of the crown

- Extensive area of gingival blanching
  - Crown may be long
  - Crown is grossly overcontoured
  - Grossly overcontoured crowns require extensive trimming in the gingival area
  - Properly trimmed crown extends .5 - 1 mm into the gingival sulcus
  - Properly trimmed crowns require less trimming in the gingival area
  - Crown margins should be trimmed to lie parallel to the contour of the gingival margin
  - If necessary, use 0.5 mm diamond to contour margin
  - Crown margins should be contoured to the gingival margin
  - Crown margins should be contoured to the gingival margin
Preparation and Placement

- Contour and crimp the crown to form a tightly fitting crown
- Contouring: bending the gingival third of the crown margins inward to restore anatomic features of the natural crown and to reduce the marginal circumference of the crown
- Contouring is accomplished circumferentially with a no. 114 ball and socket pliers or with no. 137 gordon pliers
- Final close adaptation of the crown is achieved by crimping the cervical margin 1 mm circumferentially (No. 137 pliers or special crimping pliers)
- Firm resistance when seating should be encountered after contouring and crimping

Tight marginal fit aids in...

- Mechanical retention of the crown
- Protection of the cement from exposure to oral fluids
- Maintenance of gingival health

Placement of SSC

- After seating
  - Examine gingival margins with explorer for areas of poor fit
  - Observe gingival tissues for blanching
  - Examine proximal contacts
    - If contact needs to be established it can be done with ball and socket pliers after removal of the crown
- Remove the crown with scaler or amalgam carver to engage the gingival margin
- Thumb or finger should be kept over the crown during removal so that the movement is controlled

Placement of SSC

- Rubber dam is removed and crown replaced to check occlusion
  - A crown high in occlusion 1-1.5mm can be acceptable since primary teeth spontaneously adjust over a week or so
  - Look for movement of the crown occlusogingivally with biting pressure and check for excessive gingival blanching
  - 2x2 gauze should be used once rubber dam removed to act as safety net
  - Smoothing and polishing of crown margin should be performed before cementation

Cementation

- Rinse and dry crown inside and out
- Cement: zinc phosphate, polycarboxylate, glass ionomers, or self curing resin-ionomer cement
- Fill crown two thirds with cement with all inner surfaces covered
- Dry the tooth with compressed air and seat the crown (the same way as before)
  - Handle of mirror or band pusher to ensure complete seating or patient asked to bite on tongue blade
- Check occlusion prior to cement setting
- Excess cement removed
  - From gingival sulcus-explorer or scaler
  - Interproximal-tying a knot in a piece of dental floss
- Rinse the oral cavity well and recheck soft tissues and occlusion prior to dismissing the patient
Placement of Adjacent Crowns

- Tooth prep and crown selection are similar as for a single crown
- Few areas of consideration
  - Prepare occlusal reduction of one tooth completely before starting the other; otherwise marginal ridge of the tooth will be weakened unacceptably leading to under reduction
  - Sufficient proximal reduction is a minimum proximal width of 2mm for each crown to break proximally approximately 1.5mm space at the gingival level
  - Both crowns should be trimmed, contoured and prepared for cementation together. However, the sequence of where they were seated for final fitting should be the same as when they were seated for final fitting
  - Each crown should fit individually as well as together

In areas of space loss...

- Often when tooth structure is lost due to caries—a loss of contact and drifting of adjacent teeth can occur (M-D drift)
- The crown required to fit over the buccolingual dimension is too wide mesiodistally and a crown selected to fit the mesiodistal space is too small circumferentially
- The larger crown which fits over the tooth’s greatest convexity is selected and an adjustment is made to reduce mesiodistal width
- Grasp the marginal ridges of the crown with Howe utility pliers and squeeze the crown reducing the M-D width
- Recontouring of the proximal, buccal and lingual walls of the crown with No. 137 or No. 114 pliers is necessary
- If difficulty is still encountered, additional tooth reduction on the buccal and lingual may be necessary
- If the area of space loss is in the region of the distal surface of the 1st mandibular primary molar and difficulty exists in fitting a crown—select the maxillary first primary molar crown for the opposite side of the mouth
- If several millimeters of space loss occurred extraction may be necessary

When no adjacent tooth....

- ex. Second primary molar prior to eruption of first permanent molar
- Proximal reduction should still be carried out to avoid excessive crown margin overhang (and displacement of eruption path of the permanent molar)
- May need to cut crown on distal for 2nd molars that are not fully erupted

Stainless Steel Crowns

- Most SSC look good in the mouth
- Radiographically—
  - margins are poorly adapted to proximal tooth surfaces
  - Often too long
  - Proximal contours not well reproduced
- These deficiencies have little adverse effects on the supporting periodontal tissues

SSC for Permanent Teeth

- Indications
  - Developmental defects
  - Partially erupted tooth that requires full coverage
  - Fractures
  - Gross caries
  - Interim restoration of a broken down or traumatized tooth until a permanent restoration can be placed
  - When financial considerations are a concern—used as a medium term, economical restoration in clinically suitable cases

- Occlusal reduction
  - 1.5-2mm
  - Attempt to keep cuspal inclines
- Proximal reduction
  - Slightly tapered
  - Smooth feather edge placed just below level of free gingival tissue
  - Sharp line angles should be smoothed
- Prep is same as for cast metal crown but reduction in tooth structure removed
- Future prep needs should be kept in mind
SSC for permanent teeth

- Unlike primary molar crowns, cannot be left in hyperocclusion
- If caries extends subgingivally a composite or amalgam restoration should be placed prior to crown cementation
- BW should be taken prior to cementation to check marginal fit mesially and distally
- Cement with RMGI, proper removal of excess cement

Risks/Disadvantages

- Periodontal concerns
  - If crown margins inadequately contoured or if cement remains in gingival sulcus
- Nickel allergy
- Esthetics

NuSmile Posterior Crowns

- Prep tooth as for a standard stainless steel crown—greater occlusal and circumferential reduction
- Do not excessively force crown onto tooth—find crown size that is closest fit and refine prep to fit the crown
- Can crimp lingual aspect slightly, or contour mesial and distal aspects slightly. Excessive flexure of the metal can cause fractures in the composite
- The length of the crown may be altered by trimming the gingival margins with a diamond disc—usually not necessary if tooth has been adequately prepared subgingivally
- The occlusion may be refined with a fine finishing bur
Laminated Anterior Stainless Steel Crowns

- Facing held on with mesh or by etching to material
- Not crimpable
- Wider mesiodistally
- Laminate bulky facially
- Quicker to place but susceptible to facing loss from open faced crown

References

- McDonald, Avery, Dean, Dentistry for the Child and Adolescent, Eighth Edition 2006
- Comprehensive Review of Pediatric Dentistry, Course Manual 2005