

Stainless Steel Crowns in Deciduous Molars

Purpose

The aim of this Clinical Guideline is to provide advice to public oral health clinicians regarding the treatment of deciduous molars using Stainless Steel Crowns.

Evidence-based clinical guidelines are intended to provide guidance, and are not a standard of care, requirement, or regulation. However, the application of clinical guidelines in publicly-provided oral health services allows for consistency to occur across large patients cohorts with a variety of oral health clinicians.

This clinical guideline aims to provide clinicians with the general information needed for successful restoration and preservation of primary molars with Stainless Steel Crowns (SSCs) in children.

Stainless steel crowns (SSCs) can be used in 2 ways:

1. To restore deciduous molars with extensive caries including those that have received pulp therapy,
2. To seal caries in deciduous molars without the use of local anaesthetic where caries does not extend radiographically beyond two thirds of the dentine towards the pulp (otherwise known as the Hall Technique)

Treatment modality is based on radiographic findings. It cannot be overstated how important a good readable set of bitewings are.

A Cochrane systematic review update of preformed metal crowns for decayed primary molar teeth (Innes, Ricketts et al 2015) found that deciduous molars (either with decay or that have undergone pulp therapy) that have crowns placed have a reduced risk of pain and abscess compared to deciduous teeth that have received conventional restorations.

SSCs are the treatment option of choice in deciduous teeth with; multi surface carious involvement, following pulp therapy, and/or in children at high risk to dental caries (Randall et al 2000). Stainless steel crowns are cost effective as they do not require frequent replacement as needed for GIC or multi surface Amalgam restorations and can enhance the success of pulp therapy by maintaining the coronal seal, thus preventing bacterial ingress (Moskowitz et al 2005, Gale 2000). DHSV supports the use of Stainless Steel Crowns in order to minimize retreatment by providing carefully selected patients with restorations of high quality that will function until the natural exfoliation of the tooth.

Guideline

Glass ionomer cement lacks adequate strength when used to restore multi surface carious lesions and often fracture or dislodge (Scott and Mahoney 2003). Following a systematic review of the literature Chadwick and Evans (2007) recommended that due to the failure rates (6-60% range) of GIC in class II cavities of primary molar teeth, GIC should not be used for this class of restoration. Bacterial ingress through such defective restorations lead to symptoms of pulpitis and patients may return complaining of toothache. Pulp therapy or extraction is the usual course of action in such situations. Space loss is likely to ensue after extraction, or if subjected to pulp therapy further restoration with a GIC which can eventually degrade leading to bacterial ingress with the possibility of abscess formation. Use of SSCs as the restoration of first choice can prevent the need for retreatment.

Amalgams do not degrade as rapidly as GIC and are more moisture tolerant materials. However a successful amalgam requires placement of undercuts in the proximal box and require a geometric form of cavity especially in the proximal area in order to achieve adequate strength from the bulk of the material. Such preparations can risk pulpal involvement often requiring a pulpotomy. SSCs can be useful in such situations without risking the pulp. Clinical research on longevity of multi surface amalgam restorations has demonstrated that only 40 % amalgams last beyond 4 years and the rest would require replacement due to fracture at the isthmus, partial or complete dislodgement, loss of marginal integrity or secondary caries (Mjor et al 2002, Einwag and Dunninger 1996). Each time such a restoration is replaced more sound tooth tissue has to be removed and can jeopardize the pulp. The use of SSCs can successfully prevent the deciduous teeth being subject to repeated restorative treatment. A SSC is the permanent restoration of choice in such teeth after pulpotomy.

The pulp horns of primary teeth are located under the cusps. The roof of pulp chamber plays a significant role in imparting strength to the tooth. Access cavities prepared for pulp therapy result in complete de-roofing of the pulp chamber and extending them well into the cusps. This can significantly weaken the tooth particularly in a mesio-distal direction and, when restored with an intra-coronal restoration, can risk vertical fracture of the tooth. For this reason it is mandatory to place full coverage restoration such as the SSCs in molars after pulp therapy.

Conventional Stainless Steel Crowns (SSC)

Case Selection for placing SSC

Radiographic assessment should be made with appropriate radiographs clearly showing the radicular portion of the primary teeth and the permanent tooth underlying it in order to estimate the timing of eruption of permanent successor or exfoliation of primary molar. The clinician should be clear on the diagnosis of the pulp status of the tooth being restored with SSC as treatment may fail if the tooth develops symptoms resulting from failing to perform a pulpotomy or from conducting a pulpotomy in a tooth with inflamed radicular pulp or from placing a crown on a tooth with an inadequate pulpectomy. Stainless steel crowns should be generally considered in the following situations-

Indications for using SSCs

- following pulp therapy
- for restorations of multi surface carious lesions in children under 8 years of age
- for restoration of single surface/ demineralization lesions in high caries risk patients under 8 years of age
- for treatment performed under general anaesthesia
- primary teeth with developmental defects
- fractured teeth
- teeth with extensive wear
- as an abutment for a space maintainer.

Contraindications to use of SSCs

- uncooperative patient
- inadequate tooth structure
- teeth approaching exfoliation (GIC or composite resin can be used under these circumstances)
- evidence of infection associated with the tooth in question
- evidence of a non-vital pulp

Informed Consent

Once treatment plan is decided for the patient it is important to explain to the parent the nature of the treatment and the possible outcomes. Need for elective pulp therapy should be explained appropriately, making sure parents understand what is being done and the justification for it. It is important to explain clearly to the parent and document it in the patient's record.

Clinical Steps**Local Anaesthesia**

As considered appropriate, infiltration or block is mandatory as crown preparation is extended 1 mm subgingivally and involves gingival bleeding. If pulpotomy is being done during the same visit on mandibular teeth, then, inferior alveolar block anaesthesia is recommended.

Selection of crown size

Prior to preparation the mesio-distal dimension is obtained and the appropriate size crown is selected. If severely broken down, comparison must be made with the contra lateral tooth. A snap fit at try in generally indicates good fit. If in doubt, a bitewing radiograph can be taken to confirm the size prior to cementation. Check existing occlusion bilaterally and assess for any occlusal reduction that may be required.

Isolation

Rubber dam is recommended where pulp therapy is planned. The tooth posterior to the one being treated should be clamped in order to obtain minimal interference to the hand piece and to permit preparation of the distal surface.

If distal tooth is not present (such as second deciduous molar in a 5 year old) the rubber dam will have to be removed prior to distal preparation.

Tooth preparation

Proximal reduction should be done with a fine tapered diamond bur at high speed. Avoid damaging the adjacent tooth. Approximately 1 mm is reduced creating a feather edge on the cervical aspect of the proximal surfaces. Avoid forming a step or a ledge as this will interfere with the seating of the crown. Simple test of adequate proximal reduction is the ability to pass an explorer through the contact areas. Anatomic contour of the proximal surface should be maintained. 1-1.5 mm reduction is carried out maintaining the cusp inclines and morphology. All sharp line and point angles should be rounded.

Try –In

The selected crown is tried for fit. It should be placed in a bucco-lingual direction for upper teeth and a linguo-buccal direction for lower teeth and should snap into place. Observe for adequate contacts with adjacent teeth. Check that the occlusion is not compromised. Observe for blanching around the gingival margin. If severe, then gingival margins can be crimped using the appropriate crimping forceps and gently trimmed or crown scissors and the margins polished with an abrasive green stone. The crown can be removed with an orthodontic band remover forceps, large excavator or wide back archery forceps.

Cementation

Chemically cured GIC is generally applied over all the internal fitting surfaces. Seat the crown from lingual to buccal on lower teeth and buccal to lingual on upper teeth and observe for excess cement to flow out. You can use a bite stick to assist with the placement of the SSC. Hold the crown in place for 2-3 minutes until initial setting of the

cement. Remove excess. Interproximal excess can be effectively removed prior to full set with a knotted floss.

Precautions/hazards that may be encountered during placement

It is important to note the following:

- difficulties in placement of crowns can arise with pre-existing loss of arch length due to interproximal caries;
- when fitting crowns adjacent to each other i.e. first and second deciduous molars, trial fit both together and then cement one crown at a time with the other crown that has been trial fitted still on;
- avoid placing a crown that is too large on a second primary molar as this can disrupt the eruption of the first permanent molar and potentially lead to impaction.
- Assessing child compliance is imperative prior to commencing preparation of the tooth.

Follow Up

A review visit could be organized to assess gingival health and to ensure adherence to oral hygiene. Once the clinician is satisfied patients can be placed on recall according to the current policy. Regular reviews are particularly important when first permanent molars are yet to erupt distal to the primary molar restored with a stainless steel crown.

Hall Technique**Case Selection for using Hall Technique:**

Similar radiographic elements as for a conventional SSC procedure are considered appropriate. Thus a clear view of the radicular portion of the primary teeth and the underlying permanent successor in order to estimate timing of exfoliation and eruption. In addition the assessment of pathology, should it be present.

Indications for the Hall Technique, for patients at high risk to dental caries:

- Class I lesions, non-cavitated. If patient unable to accept fissure sealant
- Class I lesions, cavitated. Small to moderate (where caries does not extend radiographically beyond two-thirds of the dentine towards the pulp)
- Class II lesions, cavitated or non-cavitated. Small to moderate (where caries does not extend radiographically beyond two-thirds of the dentine towards the pulp)

Contraindications for the Hall Technique:

- Teeth with signs or symptoms of irreversible pulpitis, or dental sepsis
- Teeth with clinical or radiographic signs of pulpal exposure, or periradicular pathology
- Unrestoreable teeth with minimal remaining tooth structure

Concerns about the Hall Technique:

Concerns about the HT tend to arise from clinicians with respect to the following issues: sealing caries, increasing the occlusal vertical dimension (ie opening up the bite), and impaction of first permanent molars on the distal aspect of the crown. Traditionally, caries management involved the complete surgical excision of dental caries affected dentine and the placement of a direct restoration. Over the last twenty years, it has become evident that it is imperative to preserve as much tooth substance as possible

(the Minimal Intervention Dentistry (MID) approach) to prevent compromising tooth structure and to maintain the health of the pulp.

Sealing caries will slow, and even stop the progress of the lesion (Innes & Evans, 2013; Innes, Evans, Stirrups, Hall, & Leggate, 2006). Three types of studies have supported the approach of sealing caries to prevent its progression: sealing caries with fissure sealant (Jensen & Handelman, 1980); stepwise excavation technique studies (two steps or single step) (Bjorndal, 2011; Mertz-Fairhurst, Curtis, Ergle, Rueggeberg, & Adair, 1998); and the Hall Technique studies (Innes, Evans, & Stirrups, 2007, 2011).

Concerns about the increase in the occlusal-vertical dimension following placement of Hall Technique crowns have been alleviated. A number of studies have found that the occlusion re-establishes itself within 2- 4 weeks following placement of the HT crown (Calache et al., 2014; Harris, Innes, Weeks, & Lamont, 2011; Innes et al., 2007; van der Zee & van Amerongen, 2010).

Finally, the likelihood of the erupting first permanent molar becoming impacted against the distal aspect of the HT crown is low (Innes et al, 2007). Impaction of first permanent molars against a crown can be managed with separator rings, and avoided with well-fitting crowns.

Clinical steps for Hall Technique

Step 1: Size the crown

The crown should cover the occlusal table of the tooth but not impinge on the teeth on either side, and there is a feeling of 'spring back'. (Generally the size of a Hall Technique Crown is one size larger than what would be used for a conventional SSC)

If necessary orthodontic separators can be placed 1-3 days prior to placing the crown

Step 2: Cementation

Chemically cured GIC is generally applied over all the internal fitting surfaces.

Step 3: Locate and Seat

Before placing the crown over the tooth, some glass ionomer cement may be wiped on the tooth or placed in any cavitation to help ensure a good seal.

The crown is placed evenly over the tooth and engaged in the approximal contact points using finger pressure to secure its position.

The child then is asked to bite down on the crown.

Step 4: wiping the excess cement.

As soon as the crown is fitted – wipe the excess cement away.

Step 5: Seating further (second seating)

The child is instructed to bite down again and asked to keep pressure on until the cement sets.

Step 6: Check and clean.

Multiple Hall Technique crown placement

Careful planning is required if a number of Hall Technique crowns are to be placed in one child. Due to the likelihood of a temporary increase in occlusal vertical dimension it is recommended that an opposing HT crown is placed only after a minimum of 4 weeks, as evidence shows that occlusion will have re-established by this time (Calache et al., 2014; Harris et al, 2011; Innes et al., 2007; van der Zee & van Amerongen, 2010). Adjacent HT crowns should be placed at separate appointments (Innes and Evans 2015).

Table 1. Diagnostic and Treatment Criteria for the Hall Technique

Radiographic Code	Category	Diagnostic criteria	Clinical signs and symptoms	treatment
R0	Sound	No radiolucency or restoration	nil	
R1	Outer half enamel lesion	Zone of increased radiolucency confined to outer half of enamel (no minimum limit) up to, but not including half way	nil	
R2	Inner half enamel lesion	Zone of increased radiolucency involving both inner and outer halves of the enamel, including lesions extending up to but not beyond the DEJ	nil	
R3	Lesion with broken DEJ border	Zone of increased radiolucency penetrating enamel with a broken DEJ border but with no obvious progression into dentine	Asymptomatic No pathology evident Or tooth sensitive due to hypomineralisation	Seal caries with crown using Hall Technique Exception: Tooth will exfoliate within 12 months

R4	Outer third dentinal lesion	Zone of increase radiolucency penetrating enamel and DEJ but confined to the outer third of dentine	Asymptomatic No pathology evident Or tooth sensitive due to hypomineralisation	Seal caries with crown using Hall Technique Exception: Tooth will exfoliate within 12 months
R5	Middle third dentinal lesion	Zone of increase radiolucency penetrating enamel and DEJ but confined to the outer two thirds of dentine	Asymptomatic No pathology evident Or tooth sensitive due to hypomineralisation nt	Seal caries with crown using Hall Tech Exception: Tooth will exfoliate within 12 months nique
R6	Inner third dentinal lesion	Zone of increased radiolucency penetrating into the inner third of the dentine with or without apparent pulpal involvement	Asymptomatic No pathology evident	Pulp therapy plus SSC
R6 or R5		Zone of increased radiolucency penetrating into the middle or inner third of the dentine with or without apparent pulpal involvement internal root resorption	Waking pain, draining abscess, lymphadenopathy,	Extraction

Evans et al 2008, after Mejare 1999

Definitions

Nil

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