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UK National Clinical Guidelines in Paediatric Dentistry*

Introduction

The sixth National Clinical Guideline in Paediatric Dentistry is entitled 'Stainless steel performed crowns for primary molars'. The process of National Clinical Guideline production began in 1994, resulting in first publication in December 1997. Each guideline has a nominated main author but the content is not a personal view; it represents rather a consensus of opinion of current best clinical practice. Each guideline has been circulated to all consultants in Paediatric Dentistry in the UK, to Council of BSPD, and to people of related specialities recognized to have expertise in the subject. The final version of the guideline is produced from a combination of this input and thorough review of published literature. The intention is to encourage improvement in clinical practice and to stimulate research and clinical audit in areas where scientific evidence is inadequate. Evidence underlying recommendations is scored according to the SIGN classification and guidelines should be read in this context. For those wishing for further detail, the process of guideline production in the UK is described in *International Journal of Paediatric Dentistry* 1997; **7**: 267–268.

Stainless steel preformed crowns for primary molars

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Introduction

Stainless steel (preformed) crowns are prefabricated crown forms which can be adapted to individual primary molars and cemented in place to provide a definitive restoration. The following guideline is intended to assist in the planning and provision of stainless steel crown restorations for primary molars.

1. Indications

Stainless steel crowns are the restoration of choice in the following situations:
1.1. Restoration of carious primary molars where more than two surfaces are affected, or where extensive one or two surface caries is present.
1.2. Following pulpotomy or pulpectomy procedures.

Stainless steel crowns may also be indicated in the following situations:
1.3. Restoration of primary molars affected by localized or generalized developmental problems (e.g. enamel hypoplasia, amelogenesis imperfecta, dentinogenesis imperfecta, etc.).
1.4. Restoration of fractured primary molars.
1.5. Restoration and protection of teeth exhibiting extensive tooth surface loss due to attrition, abrasion or erosion.
1.6. In patients with a high caries susceptibility.
1.7. As an abutment for certain appliances, such as space maintainers.
1.8. In patients where routine oral hygiene measures are impaired and breakdown of intracoronal restorations is likely.

2. Clinical procedure

2.1. Appropriate local analgesia should be obtained and the tooth should be isolated, preferably with rubber dam.
2.2. Caries removal and appropriate pulp treatment (i.e. indirect pulp capping, pulpotomy or pulpectomy) should be completed if necessary.
2.3. Appropriate tooth preparation should be

carried out, which should include sufficient occlusal reduction to avoid significant occlusal prematurity, and approximal reduction to allow the crown to be seated beyond the maximum bulbosity of the crown. The preparation should finish with a smooth feather edge cervically with no step or shoulder. Where a primary molar has no adjacent tooth either mesially or distally it is still important to carry out approximal reduction to avoid producing an excessive marginal overhang. This is particularly important on the distal surface of second primary molars where such overhangs can impede the eruption of the first permanent molar. Buccal and lingual preparation is not always necessary and may be detrimental to retention.

2.4. A crown should be selected that is a tight snap fit. Choosing the correct size is assisted by measuring the mesio-distal dimension of the tooth, or contralateral tooth, with dividers.

2.5. Stainless steel crowns produced by several different manufacturers are available in the United Kingdom. The degree of adjustment necessary to achieve a satisfactory fit is very dependant upon the make of crown used. Nichro crowns (3M Dental, Loughborough, UK) are anatomically trimmed and contoured cervically and in many instances require little or no modification. Other types have little or no cervical contouring and hence routinely require modification.

2.51. If excessively long, the margin of the crown may impede complete seating of the crown, in which case the length of the crown may be adjusted by trimming with crown shears and re-smoothing and polishing the edges with an abrasive. Although it has been customary to recommend trimming of crowns where any gingival blanching occurs, there is no evidence that this practice reduces post-cementation complications.

2.52. Over trimming of the crown margin should be avoided, because this may affect retention if it results in reduced adaptation of the crown margin into undercut areas. It is essential that the margins of the crown are well adapted into undercut areas, and this is usually achieved by crimping of the crown edges.

2.53. Special attention should be given to adaptation of the distal margin on second primary molars where the permanent molar is unerupted. Uncorrected distal overhang may result in impaction of first permanent molars.

2.6. Frequently, reduction in the mesio-distal dimension of the crown will be necessary, especially where mesial drift has resulted in loss of arch length. Moderate reduction in mesio-distal dimension can be achieved by flattening of the mesial and distal contact areas of the crown with Adam's pattern pliers. Other forms of modification, including vertically slicing one aspect of the crown and spot-welding additional segments of stainless steel band to increase the perimeter or extend the length have been described, but their efficacy remains largely untested.

2.7. Excessive occlusal interference should be avoided (greater than 1·0–1·5 mm), but a slightly premature or high occlusal contact is normally well tolerated (unlike permanent teeth).

2.8. The crown should be cemented with a luting cement. Glass ionomer or zinc polycarboxylate cements are widely advocated. However, there is some evidence suggesting that the specific choice of cement does not significantly affect retention, the most important retentive components being derived from correct contouring and crimping of the crown.

2.9. Careful attention should be paid to removal of excess cement. This can usually be effectively achieved running a pointed instrument around the margins of the cemented crown and by passing knotted dental floss bucco-lingually through the contact areas prior to the cement setting. Excess cement has been shown to be subsequently detrimental to gingival health.

3. Other considerations

3.1. Stainless steel crowns may be aesthetically improved by placement of composite resin in a buccal window cut into the labial face of the crown postfitting. Crowns with prefabricated tooth coloured buccal facings are available from specialist suppliers.

3.2. When cementing orthodontic bands to stainless steel crowns, roughening of the internal surface of the band and external surface of the crown prior to cementation has been shown to improve retention.

Explanatory notes

1.0. Stainless steel crowns are widely recognized as the most effective and durable restoration for primary molars. There have been several retrospective studies examining the longevity of stainless steel crowns in comparison with amalgam restorations [1–3]. All have shown stainless steel crowns to have markedly superior longevity when compared with multisurface amalgam restorations. A more

recent prospective study comparing stainless steel crown restorations with amalgam restorations in paired control teeth in the patients has been published which again demonstrated that the stainless steel crowns had superior longevity and required replacement less frequently [4]. Although no prospective studies have directly compared stainless steel crowns with primary molar restorations other than amalgam, retrospective data suggests that stainless steel crowns similarly out-perform glass ionomer cements and composite restorations [5].

2.3. A study by Rector *et al.* [6] failed to demonstrate that the type of tooth preparation affected retention. However, in an earlier study [7] preparations maintaining the greatest amount of buccal and lingual tooth structure were most retentive. This suggests that buccal and lingual reduction does not have any advantage with regard to retention and may even be detrimental.

2.51. Studies have failed to show any increase in supra-gingival plaque accumulation associated with stainless steel crowns [8–10]. However, crowns with defective margins, or where excess cement has been retained have been shown to be associated with an increased degree of plaque accumulation [11,12]. Several studies have investigated gingival health in association with stainless steel crown restorations. Two have suggested higher levels of gingivitis around teeth restored with stainless steel crowns [12,13]. In both these studies, however, no direct comparison was made with unrestored matched control teeth. In two further studies where matched control teeth were used no difference in the level of gingivitis around stainless steel crowns was demonstrated [9,10]. The relationship between gingivitis and marginal defects, such as poor marginal adaptation and incomplete removal of excess cement, has been clearly demonstrated by several workers [8–12]. Careful adaptation of crown margins before fitting is essential and the incidence of postfitting gingivitis may be reduced by careful polishing of the crown margin [14].

2.52. It has been demonstrated that close adaptation of the metal margins of the crown in the undercut areas significantly enhances retention [6].

2.53. The impaction of first permanent molars beneath over-hanging distal margins on poorly adapted stainless steel crowns have been reported [15]. Therefore, careful attention should be paid to adaptation of the distal margin on second primary molars where the permanent molar is unerupted.

2.7. Slightly premature or high occlusal contact is normally well tolerated (unlike permanent teeth) and clinically appears to be compensated for within a few weeks by adaptation of the dento–alveolar complex.

2.8. A study comparing stainless steel crown retention with polycarboxylate and glass ionomer cement failed to demonstrate any difference [16], and in an extensive study that demonstrated a 92% 5-year survival [3] the majority of crowns were cemented using a reinforced zinc oxide cement. Choice of cement would therefore appear to be noncritical.

2.9. Where excess cement has been retained, stainless steel crowns have been shown to be associated with an increased degree of plaque accumulation [11,12] The relationship between gingivitis and marginal defects, such as poor marginal adaptation and incomplete removal of excess cement, has been clearly demonstrated by several workers [8–12].

3.1. The aesthetic improvement of the appearance of stainless steel crowns by placement of composite resin in a buccal window cut into the labial face of the crown postfitting has been reported [17,18]. In one report [17] the restoration was followed to exfoliation 23 months later, without evidence of deterioration. Crowns with prefabricated tooth-coloured buccal facings are available from specialist suppliers.

3.2. Orthodontic band retention on stainless steel crowns has been shown to be poorer than on unrestored teeth. Roughening of the internal surface of the band and external surface of the crown prior to cementation has been shown to improve retention strength to a level comparable with those obtained on unrestored permanent molar and premolar teeth [20].

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