IN VIVO AND IN VITRO EVALUATION OF RESIN-BONDED PORCELAIN RESTORATIONS

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DECLARATION

This work contains no material which has been accepted for the award of any other degree in any university or other tertiary institution, and to the best of author's knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Summary

During the last decade, the demand by patients for tooth-coloured restorations has increased. Common problems associated with large resin composite restorations in general dental practice include wear, fracture, and secondary caries. Such problems have restricted their wide-spread use, especially in posterior teeth. Ceramometal restorations, on the other hand, require excessive tooth reduction and may also have aesthetic problems. These limitations resulted in the development of resin-bonded porcelain restorations. Porcelains are well-known as aesthetic and biocompatible materials, and can be a valuable alternative restorative material when appropriate case selection and indications for their clinical use are applied. Many in vivo and in vitro investigations of resin-bonded porcelain restorations have been reported in the literature. The aim of the present study was to investigate whether or not these investigations are relevant to private dental practice. For this purpose, the study was divided into three sections to:

1) Investigate the preparation designs used in a specialist private practice, and to compare the dimensions of the dies of fractured posterior single restorations (shell or full veneer crowns, and onlays) with those of similar intact restorations,

2) Determine the usual failure modes of resin-bonded porcelain restorations, and

3) Evaluate the survival rates of different types of such restorations in a comparative manner.

A total of 536 resin-bonded porcelain restorations were selected from a private practice in which two prosthodontists worked. The restorations comprised shell (full veneer) crowns (229), onlays (97), inlays (9), labial veneers without incisal coverage (64), labial veneers with incisal coverage (46), chip porcelain veneers (15), cantilever bridges (49),

and fixed-fixed bridges (27). Of these restorations, 103 posterior single shell crowns and onlays were selected to investigate preparation dimensions and designs. Measurements of different aspects of the preparations were taken from stone dies of the prepared teeth, for both intact and subsequently fractured restorations, and for restorations with and without metal reinforcement. Measurements were taken of the intercuspal width, isthmus width, height of axial wall, proximal width, depth of occlusal floor from central fissure, and working cusp reduction. Preparation characteristics such as preparation taper, retention grooves, margins finished in dentine or enamel, and type of finishing lines were also assessed.

The results of this study showed that the average porcelain thicknesses were often within the range of those generally recommended in the literature (1.5-2.0 mm). However, thicknesses less than 1.0 mm, and more than 4.0 mm, at the central fissures and over the working-side cusps, were also found following the removal of previous amalgam restorations, and extension of preparations into the access cavities of root canal filled teeth. Preparation dimensions tended to be slightly larger in the fractured restorations. No significant differences were found between the dimensions for shell crowns or onlays fabricated with and without metal reinforcement, although the dimensions of those restorations with metal reinforcement tended to be slightly larger. Preparation tapers were mostly between 21-40° for the intact restorations, and 10-20° for the fractured restorations. Large preparation convergences were more frequently observed after removal of amalgam restorations, but this did not compromise the retention of the restorations.

Of the 536 restorations, 123 (23%) failed. Bulk fracture comprised the highest number of failures recorded in this study (10.4%). Other restoration failures included debonding

(2.8%), pulpitis (2.8%), chip fracture (2.6%), microfracture (1.1%), colour mismatch (1%) and connector-fracture for bridges (0.6%). No recurrent caries was reported. Fixed-fixed bridges showed the highest failure rate (70%) followed by onlays (without and with metal reinforcement), chip porcelain veneers, shell crowns (without metal reinforcement), cantilever bridges, and then veneers without and with incisal coverage. Restorations survivals were analysed using life table methods. The period covered by the study records was from 1988 to mid-1995. The overall survival of all of the restorations at the 75% quartile was 58.9± 6.2 months. The results of the survival analyses showed that labial porcelain veneers with incisal coverage showed a better survival than did veneers without incisal coverage. Shell crown restorations demonstrated a better survival than did onlays, but the difference was not statistically significant. Comparison of shell crowns and onlays fabricated with and without metal reinforcement showed that those with a metal substructure survived for slightly longer than did those without a metal substructure. Shell crowns and onlays placed in the maxillary arch had better survivals than those placed in the mandibular arch. Cantilever bridges showed significantly better survivals than did fixed-fixed bridges.

The results showed that porcelain restoration thickness was not the most significant factor determining the longevity of resin-bonded porcelain restorations, since many very thin and very thick restorations survived during the period of this study. However, bulk fracture, as expected from the physical characteristics of porcelain materials, was an important failure reason. The use of metal reinforcement of the porcelain in selected cases increased the clinical survivals of the posterior restorations.