POST RETAINED CROWN FAILURE AMONGST MALAYSANS: A SURVEY

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ABSTRACT

Post-retained crown continues to be the most commonly accepted form of restoration for endodontically treated teeth. This survey was thus conducted in order to determine the clinical success rate of post-retained crowns within the Malaysian general dental practice. Six hundred and forty six failed cases were reported. Of these, approximately 58% involved the maxillary central incisors. The highest number of failures occurred between two to five years. The tapered cast post was the most common post design observed, with almost 60% surviving up to five years. However, more than 90% of the screw posts reported failed within the same period. Decementation of posts appeared to be the main mode of failure. Failures attributed to periodontal problems, fractured roots and loose crowns were also observed. Both the threaded and cast tapered posts generated the most number of root fractures. Finally, the majority of practitioners surveyed recommended retreatment of the post and crown.

INTRODUCTION

The restoration of endodontically treated teeth is the subject of great interest to the profession. The dental literature is replete with techniques and materials for the restoration of these teeth. Alternatives to the traditional cast post and cores have been described and recommended such as prefabricated posts and pins in conjunction with amalgam or composite resins. However, there is poor clinical documentation of the effectiveness of each recommended technique. Failures occur frequently enough to question whether our criteria for the adequate design of the post and core should be re-evaluated. Moreover, conflicting in vitro studies offer few guidelines for efficient post and core systems rendering selection difficult and confusing.

This is partly attributable to the superior adaptation of the amalgam and composite resin to the surface of the post. A further advantage of composite resin is its ease of handling and rapid polymerization and the possibility of completing a preparation within a few minutes of placement. Despite these advantages, studies have shown that composite resins have poor dimensional stability, demonstrate polymerization shrinkage which may cause cuspal movements and interact with the eugenol used in most temporary cements causing surface porosity. In addition, it has been shown that composite cores provided less retention for cast gold crowns than did the amalgam cores, but over a long term period the composite gave increasing retention.

The clinical success of post retained crowns is not very encouraging when compared to other types of restorations. Roberts found that post crowns had the highest failure rate among major bridge retainers. Another study suggested that failure of the post retained crowns could be attributed to inadequate clinical or laboratory techniques rather than to the materials or biological factors. This study thus attempts to investigate quantitatively the causes of failure of post-retained crowns within the Malaysian general dental practice.

METHOD

A questionnaire was prepared and circulated with a covering letter to 1218 private dental practitioners throughout Malaysia requesting completion of the questionnaire for any patient presenting with a failed post crown. Two sets of questionnaires were sent to each practitioner, generating a total of 2436 possible replies. The practitioners were also informed that post documented cases of failure could also be used as reference.

Six hundred and forty six completed questionnaires were received and evaluated. The sample contained 322 male and 334 female patients.

RESULTS

The frequency distribution of the various races showed that the highest failure rate was observed amongst the Chinese population (Fig. 1). The majority of patients fell within the 31 to 40 age group, which made up almost half of the entire population reported (Fig. 2). In general, approximately 95% of teeth which failed was located in the upper arch. More than half of the cases reported involved the maxillary central incisors. Figures 3a and 3b show the number and types of teeth as seen in this survey. The majority of the failures reported were on teeth which had not been crowned previously (Fig. 4). The reasons for the original restorations were many and varied (Table 1). Fifty three percent of the cases were crowned following root canal treatment while less than 2% were crown for cosmetic reasons. In addition, a considerable number of these teeth were provided with porcelain bonded to metal crowns (68%).

The period from crown placement to failure gives an indication on the life span of post retained crowns (Fig. 5). In this survey, 178 crowns failed between 1 to 2 years while 282 failed between...
2 to 5 years. The number of crowns which failed after 5 years was slightly higher than that which failed in under a year.

The tapered cast post was the most common post design observed in this survey and in combination with the screw post, they constituted 83% of the entire population seen. Table 2 shows the number of failures associated with each post type. As expected, the number of cast cores observed closely paralleled the percentage of post crowns used. Another common material employed as a core was composite which was seen in 25% of the failed cases.

Table 2: Types of materials used for post

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapered cast post</td>
<td>327</td>
</tr>
<tr>
<td>Screw post</td>
<td>211</td>
</tr>
<tr>
<td>Parallel sided cast post</td>
<td>50</td>
</tr>
<tr>
<td>Stainless steel post</td>
<td>30</td>
</tr>
<tr>
<td>Wrought gold post</td>
<td>24</td>
</tr>
<tr>
<td>Ceramic</td>
<td>4</td>
</tr>
<tr>
<td>Amalgam</td>
<td>0</td>
</tr>
</tbody>
</table>

The majority of cases, no periapical radiograph of the affected teeth were taken, in instances where a radiograph was utilised, 25% of the cases displayed some periapical radiolucency while in a small number of cases the post had perforated the root.

DISCUSSION

This survey attempted to identify the causes and the features of failure of post retained crowns within the Malaysian population. Almost all of the teeth which failed were located in the upper arch (95%). Of these, more than half of the cases involved the maxillary central incisors.

Table 3: Post type and life span

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Under 1 yr</th>
<th>1-5 yrs</th>
<th>Over 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapered cast post</td>
<td>60</td>
<td>106</td>
<td>100</td>
</tr>
<tr>
<td>Parallel sided cast post</td>
<td>7</td>
<td>178</td>
<td>34</td>
</tr>
<tr>
<td>Stainless steel post</td>
<td>7</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Screw post</td>
<td>7</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Wrought gold post</td>
<td>7</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td>Ceramic</td>
<td>1</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Amalgam</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

When the causes of post retained crown failure were analysed (Table 4), the majority of the cases had complained of loosening of the post. The number of failures attributed to periodontal problems, loose crowns and/or fractured roots were almost comparable. With the exception of wrought gold and ceramic posts, decontamination of the post appeared to be the main mode of failure for the stainless steel and screw posts as well as the tapered and parallel sided cast posts. The screw post in combination with the tapered cast post also generated the most number of root fractures.

Table 4: Post type and failure

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Loose Crown</th>
<th>Poor Aesth.</th>
<th>Perio. Caries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapered cast post</td>
<td>130</td>
<td>36</td>
<td>35</td>
</tr>
<tr>
<td>Parallel cast post</td>
<td>19</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Stainless steel post</td>
<td>18</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Screw post</td>
<td>84</td>
<td>15</td>
<td>35</td>
</tr>
<tr>
<td>Wrought gold post</td>
<td>2</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Ceramic</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Amalgam</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>255</td>
<td>54</td>
<td>75</td>
</tr>
</tbody>
</table>

*48 cases with more than one cause of failure

Table 5: Recommendations following failure

<table>
<thead>
<tr>
<th>Recommendation Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redo post and crown</td>
<td>252</td>
</tr>
<tr>
<td>Recementation</td>
<td>184</td>
</tr>
<tr>
<td>Redo crown</td>
<td>99</td>
</tr>
<tr>
<td>Extraction</td>
<td>79</td>
</tr>
<tr>
<td>Apicoectomy</td>
<td>45</td>
</tr>
</tbody>
</table>

*13 cases with 2 recommendations
The period from crown placement to failures gives an indication of the service life span of the restoration. The highest failure rate occurred between two to five years while the number of crowns which failed within one to two years and after five years were comparatively lower. Only a very small number of cases failed after ten years (38 out of 666) indicating that if a crown fails, it is more likely to do so relatively soon after cementation. This is in agreement with another study by Turner who observed that once the initial failure rate period was over, the restoration was likely to function for several more years.

Loosening of posts accounted for more than half of the failed cases indicating that attention should be given to the retentive design of the dowel and preparation. In this study approximately 50% of the documented post failures involved tapered design. A higher failure rate of over 60% were quoted in earlier studies by Lewis et al and Turner. Tapered posts have tested poorly in comparative studies of retention. Unfortunately, it was not possible to establish whether or not the documented cast tapered posts were constructed via the direct or indirect technique. The incidence of failure observed with parallel sided post systems was noticeably lower than the tapered system (16%). In the small number of failures that did occur, most parallel sided posts failed by decementation. However, they are not recommended unless sufficient dentine remains for cylindrical channel enlargement. In addition, studies simulating trauma have shown that stainless steel parallel sided posts demonstrated higher resistance to fracture during impact. Thus, this internal design whether be it cast or prefabricated is recommended where possible.

The number of failures due to periodontal problems, loose crowns and fractured roots were almost comparable. A high incidence of root fracture was observed with the cast tapered and screw posts. In a photelastic analysis study by Deuch et al, tapered posts generated a favorable stress distribution pattern as compared to parallel, cylindrical posts. A retrospective study on endodontically treated teeth by Sorensen and Martinoff found that the type of tapered posts which had failed caused unrestored root canal/ tooth fracture. However, the sample size was small which restricted generalization. The authors attributed the angular and vertical root fractures to hydraulic pressures induced during cementation of the cast posts and cores. In vitro investigations on threaded posts demonstrated high stress levels associated with the installation of the system and frequent root fracture. Another study observed high levels of stress when screw retained crowns were subjected to loaded and unloaded states. This may explain the relatively large number of root fractures associated with tapered and screw posts. However, all modern screw post system are pre-threaded where the posts are designed to be cemented into canals which have been tapped previously. It is hoped that the passive placement will reduce or eliminate fitting stress.

It is also interesting to note that periodontal problems caused considerably less failure than caries. This may be an indication that at present periodontal disease is not a controlled disease in patients who have been prescribed major restorative work.

The recommendations proposed following failure rates, the recommendation of the dislodged part to extraction. In this survey, the most widely recommended form of treatment was the provision of another post retained crowns. Recementation was also carried out in a considerably high number of cases. This form of treatment is feasible only if the post and/or crown were regarded as suitable for recementation. The disruption of the cement lute most likely resulted in failure in the absence of other predisposing factors. Removal of the tooth was advised in 79 cases while 45% required an apicectomy to possibly establish an apical seal and eliminate periapical disease.

The length of the post preparation has been the subject of conflicting opinions in the literature. Various guidelines have been recommended for dowel length which includes the length of the clinical crown,4, 12, 17, 30 (2) equal to half the length of the remaining root,31 (3) midway between the apex and height of the alveolar crest,24 (4) leaving 5 mm of root filling material apically31 or (5) a minimum depth of 7 mm from the canal orifice. Unfortunately, this survey did not delve into the aspect of failure associated with various dowel lengths. Since it was envisaged that radiographic facilities were not available routinely to every dental practitioner, it was decided to omit this factor entirely in view of the difficulty in categorizing and ascertaining the length of the post with respect to the diversity of recommendations proposed. However, the importance of this factor cannot be ignored. Investigations have demonstrated a significant relationship between vertical resistance to displacement and dowel length.10, 14 Photelastic tests have also shown a reduction in stress concentration with increased post length.13 A review of the literature revealed no significant effect on the apical seal when 4 mm or more of gutta-percha remained apically.24 It is therefore recommended to attain as great a length as possible with a minimum of 4 mm of gutta-percha for an apical seal. However, the end must justify the means. Overpreparation of the post space may weaken the tooth by removing sound dentine26 thus reducing the resistance to fracture or cause root perforation.8 The chances of success can be increased by minimizing the diameter of the dowel and knowing the root morphology and the importance of the bulk of dentine to the strength of the endodontically treated tooth.

CONCLUSION

The results of this survey confirms the need for a closer consideration of the problems associated with the provision of post-retained crowns. A wide variety of designs and materials are available to the practitioner. The dentist must be aware and evaluate the merits of each type of post system and its suitability in order to prolong the longevity and serviceability of the tooth.

Finally, it has been commonly accepted to provide coverage for pulpless teeth with minimal tooth structure or large multiple restorations. But controversy has raged over the use of coronal coverage on teeth with nearly intact coronal structure. Some dentists favour coronal coverage, while others advocate filling the access cavities of these teeth.5, 45, 44 No matter which type of restorative concept is used, the preservation of all remaining sound dentine should be the primary objective to preserve maximum tooth strength.

REFERENCES