The Use of Post and Core in Public and Private Swedish Dental Care

- A Questionnaire Study

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ABSTRACT

Post and core-systems are common techniques in oral rehabilitation of teeth with inadequate structure which do not allow using of the traditional restorations. Many factors can affect the treatments’ success and survival rate. The aim of the present study was to evaluate the use and experience of post and core systems in public and private Swedish dental care.

The hypothesis was that prefabricated post in composite material is the most common post and core-system used in Swedish dentistry today. Complication rates are higher for teeth with post and core and crown restorations compared with teeth restored with only crowns but without post/core. Furthermore, the risk of catastrophic failure is more frequent for teeth restored with post and core than without.

A survey was conducted by sending 500 questionnaires to dentists in public and private dental care in five different cities of Sweden. Results were compiled by 297 returned surveys and showed that the most used technique was individually cast post and core and the most used material was metal alloy post and core.

Conclusion: Individually cast post and core was found to be the most used technique both in public and private dental care in Sweden. Fiber reinforced composite was considered as the material with highest complication rates while metal alloy post and core was the material with lowest complication rates. Root fracture was the most common complication reported. The ferrule effect was considered as the most important factor affecting the survival rate of treatment with post and core.
INTRODUCTION

Post and core-systems are commonly used in oral rehabilitation when supporting tooth substance cannot be provided for rehabilitation with fixed partial dentures. There are many factors to consider in order to get a successful rehabilitation using post and core. Essential is the amount of tooth substance left, both the length and the diameter of the root. The length is important in order to get enough remaining root filling material after root canal preparation and the possibility to get a proper seal between the post and root filling material (Torbjörner, 2013). The diameter is important in order to get enough dentin left after preparation. It should be remembered that the post does not strengthen the tooth but rather weaken it. Furthermore, another important factor which can affect the treatment success is the so-called ferrule effect, meaning the possibility to make a preparation that allows the covering construction to embrace the core and tooth adequately (Mamoun, 2014). The ferrule should be at least 2.0 mm in height of dentin, giving a collar coronal to the crown margin. Clinical studies show that a proper ferrule is a key factor to get a successful treatment (Torbjörner, 2013; Juloski J et al., 2012).

Post and core- systems can be divided into different techniques including different types of materials which can be used depending on the clinical situation. The systems can be divided in active or passive retention (Torbjörner, 2013). They can also be divided in individually cast metal post and cores made by gold, titanium or cobalt-chromium, or prefabricated post and cores made by carbon-, quartz- and glass fibers or ceramic materials (Torbjörner, 2013). Prefabricated post and core can be divided in direct and indirect technique. The direct technique is used when the tooth can be prepared, post inserted and core constructed at the same treatment session. The indirect technique requires that an impression, including the prefabricated post, is sent to a dental laboratory where a post and core is produced, by either a prefabricated metal post or with a plastic burnout post, and wax the core on it before casting (Torbjörner, 2013).

Several studies have concluded that placement of post increase the survival of reconstructions (Zhu et al., 2015). Reasons for failures are root fractures, loss of retention and/or endodontic complications. Adhesive failure or loss of retention and endodontic complications correspond to 37 % respectively of all failures (Rasimick et al., 2010). In short-term studies, no difference in survival rate between the metal and fiber
posts have been reported. Clinical studies show that there is no significant difference between fiber and metal posts in the incidence of root fractures (Fiqueiredo et al., 2015). However, prefabricated metal posts showed higher failure rates than cast posts (Theodosopoulou and Chocildakis, 2009). Furthermore, carbon fiber posts show higher failure rates compared to glass fiber posts (Theodosopoulou and Chocildakis, 2009).

Short-term studies over a period of two years showed that 12% of treatments with fiber reinforced composite post failed (Dikbas and Tanalp, 2013). Studies over a five years period showed survival frequency of 71.8% for glass fiber posts (Dikbas and Tanalp, 2013). In a pilot study over a seven years period it was showed that survival key factors are depending on the ferrule effect and the remaining number of cavity walls, not on the material or the post system used (Dikbas and Tanalp, 2013).

Another factor affecting the outcome of treatment with post and core are the type of cement and how it is applied. *In vitro* studies show that self-adhesive resin cement gives better retention than regular resin cements in glass fiber posts (Skupien et al., 2015; Sarkis-Onofre et al., 2014).

The complications are also depending on type of covering restoration and location of the tooth (Raedel et al., 2015) The risk of failure is lower for posterior teeth than anterior (Raedel et al., 2015).

A systematic review based on clinical studies with high evidence, made a comparison between the different materials used for post and core. Carbon fiber composi-posts were found to be significantly more successful compared to cast posts. On the other hand, prefabricated metal posts were found to be not as successful as the glass fiber posts but more successful than carbon fiber post (Theodosopoulou and Chocildakis, 2009).

Many dentists avoid to use post and core if possible because of the difficult clinical procedure and the opinion that there are lots of complications related to the use.

The aim of present study was to evaluate the use and experience of post and core systems in public and private Swedish dental care.
The hypothesis were that prefabricated post in composite material is the most common post and core-system used in Swedish dentistry today, that complication rates are higher for teeth with post and core and crown restorations compared with endodontically treated teeth restored with crowns but without post and core. Furthermore, that the risk to get catastrophic failure is more frequent for teeth restored with post and core than without.

**MATERIALS AND METHODS**

**Pilot study**

A pilot study was performed to evaluate the questions. Twenty pilot questionnaires with approximately 20 questions were distributed to clinical teachers and other dentists working at the Dental school in Umeå. They were asked to evaluate whether the questions were acceptable or difficult to understand.

**Questionnaires**

Based on the result of the pilot study and articles from a Pub-Med search, a questionnaire including 21 questions was designed (Appendix 1). The first question was if post and core was used or not. If the respondent answered yes, he/she could proceed with the questionnaire about the most used technique, material choice, complications, and survival. If the respondent answered no, he/she could give the main reason and go forward to questions 16-21 concerning age, gender, education area, working in private or public dental care and where the clinic was located.

**Participants**

A web search using a local Swedish web search portal (Eniro), made it possible to get contact information to dentists in private and public dental care. Thus, 250 dentists in private and public dental clinics respectively, from five different cities of Sweden; Stockholm, Malmo, Gothenburg, Umeå and Luleå were identified. Randomization of the dentist from the selected cities resulted in rather few dentists. Therefore, all the dentists found in the web search in the different cities were selected to be contacted.

The names on the lists of the identified dentists were coded by a number and each questionnaire received a corresponding code number. The list was then handed to the
tutor after a postal reminder. All information connected to the encrypted list was also deleted from the computer at the same time.

An invitation/information letter together with the questionnaire and a postage paid return envelope were sent to the different dentists. A reminder with a short letter was sent after one month to the dentist who had not replied.

**Literature search**

In the PubMed web search following keywords were used: dental post and core AND RCT, dental post and core AND systematic review, prefabricated post and core AND systematic review, dental post and core AND survival AND systematic review.

Only articles written in English and published during the last ten years, dealing with post and core materials, survival, and complications were included, resulting in all-together 14 relevant articles. One article and a book about expected response rate and formulation of questionnaire studies were also included. Furthermore, two book-chapters about post and core were also included as references.

**Ethical considerations**

Ethical considerations of the project were described and evaluated by the Ethical Forum at the Department of Odontology. In order to protect the identity of potential participating dentists, the questionnaires were encrypted and this was pointed out in the invitation letter as well as that the participation was voluntary. By returning the questionnaires it must be considered that the participating dentists had given their consent.

**Statistical Analysis**

Microsoft Office Excel 2016 was used to inserting data. A comparison between the answers from the public and private dental care was carried out. Chi-square and Fisher’s exact tests were used to evaluate the difference in answers between the groups and a significance p-value was defined as < 0.05. The null hypothesis was that there is no difference between the answers from the two groups. The data analysis was performed by using IBM SPSS Statistics.
RESULTS
Of the 500 distributed questionnaires, 297 were returned after one reminder (response rate 59.4 %). Table 1 display the demographic information, age, gender, private or public dental care, and dental school for education. Table 2 display the number of distributed and returned questionnaires from five different cities of Sweden, both in private and public dental care.

A comparison between the answers from the public and private dental care was done in order to see if there were differences.

The majority of the respondents (94.3 %) used post and core. Some reasons stated for not using post and core were

- The treatment had a bad prognosis due to root fractures
- The use of adhesively luted ceramic crowns
- Lack of experience
- High costs

A statistically significant difference (P < 0.05) was found between the public and private dental care concerning most used post and core technique. The individually cast post and core was the most used in public dental care (70.7 %) while prefabricated post and individually cast post and core were equally used in private dental care (37.6 % and 38.4 %, respectively).

Factors deciding the choice of techniques were mainly biological factors, as the length of the root filling (88.3 %). Factors as patient economy and length of the treatment period were of little importance. No statistic significant differences were found between public and private dental care (P > 0.05).

Most used materials for post and core is presented in figure 1. A statistic significant difference (P < 0.05) was found between public and private dental care.

The main reason for choosing these materials was their mechanical properties (77.3 %). How manageable the material was (9.9 %), biological properties (4.3 %), economy (3.9 %). Aesthetic, experience and prognosis (a total of 3.9 %) were of minor importance.
No statistic significant difference was found between the public and private dental care (P > 0.05).

Experience of material with frequent complications showed that fiber-reinforced composite had the highest answer frequency (41.1 %) but many dentists answered that they didn’t know (31.9 %). Other materials showed lower answer frequencies, alloyed metal cast post and core (13.5 %), prefabricated metal post (11.7 %), and ceramic post (1.8 %). No statistic significant difference was found between the public and private dental care (P > 0.05).

Experience of materials with low complication rates showed a significant difference (P < 0.05) between public and private dental care. Dentists in public dental care found cast metal post and core to have low complication rate (65 %) compared to dentists in private dental care (52.8 %).

The most common complication reported was root fracture (61 %) followed by adhesive failure (21.3 %). No statistic significant difference was found between the public and private dental care (P > 0.05).

Both public and private dental care found root fracture as the most catastrophic complication but there was a statistic significant difference (P < 0.05), 96.8 % of dentists from the public dental care compared to 84.8 % from the private.

On the question about which material/technique gave more catastrophic complications, the majority answered that they didn’t know (35.5 %). A statistic significant difference (P < 0.05) was found in between the public- and private dental care, 28.8 % of respondents from private dental care reported cast post and core as the material with catastrophic complications compared to 18.5 % of respondents from the public dental care.

The majority of the respondents (55.3 %) answered that they didn’t know which material/materials were most common in relation to early complications. However, early complications were related to fiber reinforced composite (32.3 %), prefabricated metal posts (8.5 %), cast posts (2.8 %) and ceramic posts (1.1 %). No statistic significant difference was found in the responses between the public and private dental care (P > 0.05).

Late complications were related to cast posts (35.8 %), fiber reinforced composite
prefabricated metal posts (9.9%) and ceramic posts (1.8%). Of the respondents 37.6% answered that they did not know. No statistic significant difference was found in the responses between the public- and private dental care (P > 0.05).

Of the respondents 74.8% experienced lower complication rates for teeth restored with crowns but without post/core compared with teeth restored with post and core and crown restorations.

The main factors affecting the survival rate of treatment with post and core is presented in figure 2. No statistic significant difference was found between the public- and private dental care (P > 0.05).

**DISCUSSION**

This study was made in order to examine techniques and materials used, complications and important factors correlated to survival of post and core treatments of teeth before crown- and bridge therapy, by dentists in public- and private dental care in Sweden.

The questionnaires were distributed to 500 Swedish dentists and the response rate was 59.4% which can be considered a relevant proportion to get relevant answers about the questions. Studies have shown that response rates between 58-65% are considered acceptable in order to get a valid result (Ejlertsson, 2014; Leece et al., 2004). However, the response rates from the different parts of Sweden were somewhat higher from public dental care (60-78%) than from private dental care (43-100%) (Table 2).

The results showed that individually cast post and core was the most used technique in Swedish dentistry today. However, there was a difference between public and private dental care, in the latter prefabricated and individually cast post and core were used equally. However, the results contradict our hypothesis that the prefabricated post in composite material is the most used post and core-system. The results are somewhat surprising since cast post and core consume more time and preparation than prefabricated post and core regardless of material (Theodosopoulou and Chochildakis, 2009).

Biological factors, as the length of the root filling were the most reported reason for the choice of post and core technique. This is in agreement with the literature and also from dental education in Sweden which suggested that factors as length, diameter, and surface of post affects the treatment success (Torbjörner, 2013).
The public and private dental care reported mechanical properties of materials as the most important reason for using these materials. This is in agreement with Pereira et al., (2014) who showed the importance of the biomechanical properties of materials when the remaining amount of tooth substance had been reduced. In other words, the strength and the survival rate of fatigued root filled teeth can be affected by the type of the used post materials.

Fiber reinforced composite post and core were experienced to give most frequent complications. In studies, there are somewhat different results concerning the complication rates of different materials. Carbon fiber composi-posts has been found to be significantly more successful compared to individually cast posts but on the other hand, prefabricated metal posts have been found to be not as successful as the glass fiber posts but more successful than carbon fiber post (Theodosopoulou and Chochildakis, 2009).

Root fracture of post and core treated teeth was reported as the most common complication followed by adhesive failure. This is in agreement of reported complications in the literature. A retrospective study (Theodosopoulou and Chochildakis, 2009) showed that root fracture was the most common reason of the treatment failure. Goodacre (2010) and Barfeie et al. (2015) showed that adhesive failure was the most common complication associated with fiber posts.

Materials with catastrophic complications were considered by the respondents as cast, prefabricated fiber reinforced composite and prefabricated metal post and core. This corresponded to the results presented in a systematic review and meta-analysis which showed that catastrophic failure incidence (root fracture) was the same for metal (cast and prefabricated) and fiber reinforced post (Fiqueiredo et al., 2015).

The majority of the respondents in the present study reported that they didn’t know which materials led to early, late and catastrophic complications. An explanation can be the absence of follow-up of treatment or lack of experience. In an article of Mamoun (2014) it has been argued that despite of all in vitro studies about post and core-system it is still hard to correlate the results in different clinical situations. Therefore, clinical long-term follow-up studies are of utmost importance to get credible knowledge about the clinical out-come of different systems.
Result showed that complication rates were believed to be higher for teeth with post and core and crown restorations compared with endodontically teeth restored with crowns but without post/core. This is in contradiction to a systematic review by Zhu et al. (2015) which showed a higher risk to get catastrophic complications in teeth without post and core.

The most important factors reported to affect the survival rate was the ferrule affect, post placement and the remaining coronal walls. This is in agreement with several studies. Mamoun (2014) and Juloski et al. (2012) emphasized the importance of the ferrule effect and Zhu et al. (2015) reported that post placement could reduce the catastrophic failure rate.

This questionnaire survey was based on a rather limited number of dentists making the results somewhat uncertain. Furthermore, even if an attempt was done to evaluate the questions in the questionnaire some of them resulted in answers which indicates that they were difficult to understand. More studies with larger numbers of surveys and well-formulated questions sent to more cities of Sweden need to be done to get a more relevant result.

**Conclusion**

Individually cast post and core was found to be the most used technique generally, both in public and private dental care in Sweden. Fiber reinforced composite was considered as the material with highest complication rates while alloy cast post and core was considered as the material with lowest complication rates. Root fracture was the most common complication reported. The ferrule effect was considered as the most important factor affecting the survival rate of treatment with post and core.
REFERENCES


TABLES

Table 1. Demographic Information allotment according to the Training Institution

<table>
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<th>Stockholm</th>
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<th>Gothenburg</th>
<th>Umea</th>
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<td>34</td>
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<td>10</td>
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<td>8</td>
<td>3</td>
<td>2</td>
<td>32</td>
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<td>40</td>
<td>18</td>
<td>10</td>
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<tr>
<td></td>
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<td>17</td>
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<td>3</td>
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<td>22</td>
<td>29</td>
<td>16</td>
<td>3</td>
<td>132</td>
</tr>
<tr>
<td>Public</td>
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<td>29</td>
<td>52</td>
<td>25</td>
<td>12</td>
<td>165</td>
</tr>
<tr>
<td>Total (persons)</td>
<td>109</td>
<td>51</td>
<td>81</td>
<td>41</td>
<td>15</td>
<td>297</td>
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</table>
Table 2. Number of Send and Returned Surveys to Five Different Parts of Sweden in Private and Public Dental Care.

<table>
<thead>
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<th>Public Dental Care</th>
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<th>Private Dental Care</th>
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<td></td>
<td>Send</td>
<td>Returned</td>
<td>Response rate</td>
<td>Send</td>
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<td>Stockholm</td>
<td>89</td>
<td>60</td>
<td>67 %</td>
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<tr>
<td>Malmo</td>
<td>59</td>
<td>39</td>
<td>66 %</td>
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<td>Gothenburg</td>
<td>74</td>
<td>46</td>
<td>62 %</td>
<td>48</td>
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<td>Lulea</td>
<td>10</td>
<td>6</td>
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<td>Umea</td>
<td>18</td>
<td>14</td>
<td>78 %</td>
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<tr>
<td>Total</td>
<td>250</td>
<td>165</td>
<td>66 %</td>
<td>250</td>
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</table>

Total: 297 /500 questionnaires
Figure 1. The Most Used Materials in Public and Private Dental Care.
Figure 2. The Most Important Factors Affecting the Survival Rate.