Endodontically Treated Teeth in General Dentistry-
Identification of Factors Related to Treatment

Result

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ABSTRACT

There are various factors that affect the success and outcome of root canal treatment. The aim of the study is to thoroughly investigate the prognosis of endodontic treated by general dental practitioners in the region of Västerbotten, Sweden, and try to identify factors that are related to an unsuccessful root canal treatment. Our hypothesis is about prognosis for teeth, which are treated by a general dentist, is worse than the teeth, which are treated by specialists, and dental students.

Total 210 patients were included in our study. Of those 100 were excluded due to lack of documentation. We analysed these factors, aseptic treatment e.g. rubber dam, quality of root filling length, coronal restoration, and radiograph after 4 years.

In our study, rubber dam was used only in 64 teeth (58 %) throughout whole treatment and only in 27 teeth (22 %) have seen that root filling follow the standard criteria. Twenty-two teeth (20 %) have received coronal restoration and only 21 teeth (19 %) had radiograph after 4 years, six teeth (5 %) had retreatment and 5 teeth (4 %) have been extracted. Lack of documentation was another striking finding which made it difficult for our study to extract complete information.

In conclusion, we identified some factors, which can be improved.

- Inadequate documentation.
- Deficiencies in pre-treatment diagnostics.
- Aseptic treatment e.g. rubber dam
- Failure in follow-up documentation of treated teeth
- Quality of root filing.
INTRODUCTION

In spite of the substantial improvement in dental health in Sweden the amount of endodontic treatment is increasing (Tabassum and Khan, 2016) and annually, about 250,000 teeth are receiving root canal treatment (Dahlström, 2016).

Factors that can damage the pulp are caries, cracks, deep restoration and traumatic treatment of dentin (Socialstyrelsen, 2016) that can cause an inflammation in the pulp and further resulting necrosis and bacteria invasion. As a consequence, the inflammatory process results in a bone loss in periapical area (Skudutyte-Rysstad and Eriksen, 2006).

The purpose of root canal treatment is to remove the bacteria that initiated an infection and / or to avoid reinfection along the root filling into the apex region by tightly filling the cleaned root canals (Singh et al., 2015; Ørstavik and Pitt Ford, 1998).

Generally, the root canal treatment fails when treatment is far from acceptable standards (Strindberg, 1956). To achieve optimal root canal results is fairly difficult because the treatment procedure is technically complex (Dahlström, 2016). It is confirmed by a study showing that the technical quality of the root canals is unsatisfactory in half of the teeth, 52% (Ridel et al., 2006) and this is one of the reasons why some teeth do not respond to root canal treatment (Siqueira Jr, 2001). Another important factor associated with the failure of endodontic treatment is lack of aseptic working procedures and persistence of microbial infection in root canals. There are however, other factors resulting unsuccessful treatment such as broken instruments in the canal, perforations and level of root filling. All these factors alone or together may cause poor prognosis (Haji-Hassani et al., 2015).

Proper isolation in order to avoid contamination of tooth is a necessary requirement for a successful endodontic treatment (Lin et al., 2014). In several studies, a link has been established between the quality of a root canal treatment and apical periodontitis. Root canal treatments with inadequate length of root filing will increase the presence of apical periodontitis (Dahlström, 2016). The best results at the root filling reached within 2 mm from the apex, and tight sealing in order to prevent recontamination (Tabassaum and Khan, 2016). Generally, 91 % successful treatment has shown by dental students (Sjögren et al., 1990) compared with root canal treatments in general dentistry that has a low success rate about
61 % (Bernstein et al., 2015).

The success rate of endodontics treatment differs depending on different cohort and definition criteria for successful treatment. Some follow the strict criteria by Strindberg to assess the outcome of root canal treatment (Strindberg, 1956) while others use more simplified criteria such as lack of symptoms and when there is not any or progression of periradicular radiolucency after treatment (Bender et al., 1966). The majority of studies regarding prognosis of endodontic treatment are done on root canal treated by either a specialist or a student under supervising of a specialist.

The hypothesis is that the endodontic outcome is less favourable for teeth treated by a general dentist compared to teeth treated by dental students. The purpose of this paper is to thoroughly investigate the endodontic outcome of teeth treated by general dental practitioners in the region of Västerbotten, Sweden, and try to identify factors that are related to an unsuccessful root canal treatment.

**MATERIAL AND METHOD**

The material comprised a total of 3500 patients who had undergone endodontic treatment in one of 35 dentals clinics in Västerbotten in 2012. Using Microsoft Excel 97 random number generator six patients from each clinic randomly selected. In total 210 patients whom received root canal treatment in 2012 were included in this retrospective study. All necessary information inclusive x-ray pictures were extracted from T4 data base. Data regarding these patients were extracted in 2016. All patients’ medical record was treated anonymously based on the information collected from journals and X-rays, outcome assessment of endodontically treated root canal has been studied. In order to obtain maximal patient’s security and integrity all patients were coded anonymously in an excel file.

The factors which were collected from the T4 data base include: tooth diagnosis if it was available, gender, age at the time of the root canal treatment, rubber dam use, and total number of visits. The available x-rays were evaluated in order to study quality of the root fillings, outcome of treatment and determine whether rubber dam was used or not.
Due nature of this paper which is a descriptive rapport of only one cohort no static analyse could be done.

To evaluate outcomes of endodontic treated teeth, X-ray images if available by Strindberg's criteria (Strindberg, 1956). Treatment was considered successful when: (a) the periodontal contours, width, and structure of the periodontal margin were normal or (b) the periodontal contours were widened mainly around an excess of filling material (Strindberg, 1956). All cases in which those criteria were not fulfilled were judged as unsuccessful. The clinical criteria for success were total lack of symptoms.

**Ethical concerns**

This study is part of the improvement of treatment quality in Folkhälsovården in Västerbotten County Council. The Ethics Forum at the Department of Dentistry, Umeå University believes that appropriate ethics have been integrated into this degree project. The ethical problem that may arise in connection with this study may be that the patient's identity can be revealed. Therefore, all patient records must be treated anonymously based on the information collected from the journal and X-rays. To achieve maximum patient security and integrity, all patients were anonymously coded in an excel file and all first and last names were deleted. This meant that it was not possible to identify these patients at all. Potential benefits of this study were to detect the shortcomings that may exist in a general dental care and, in some way, contribute to improvement in certain routines.

**Literature search**

In order to prepare us for this study, we conducted some research by reading text book on subject and some related articles. The next step was searching in PubMed using key words such as: “root canal treatment”, “outcome”, “prognosis”, “prosthetics restoration”, “rubber dam”, “endodontic diagnosis”, “quality of root filling”, “Strindberg’s strict criteria” and “One or two visits endodontic”. Most of the articles that were studied before starting the experiment had been published within the last 10 years and these articles were about just human species.
RESULTS

The material comprised a total of 3500 patients who had undergone endodontic treatment in one of 35 dental clinics in Västerbotten in 2012. Using Microsoft Excel 97 random number generator six patients from each clinic randomly selected. In total 210 patients whom received root canal treatment in 2012 of which 86 were molar, 72 premolars and 52 incisors. Hundred teeth, 42 molars, 41 premolars and 17 incisive were excluded, due to lack of clinical information leaving a total of 110 teeth (See table1).

There were more male 73 teeth (66.4 %) then female 37 (33.6 %) and the age of patients varied between 20 up to 83 years of age whit average of 48 years.

The occurrence of initial diagnosis was modest. In fact, only 66 (60 %) of teeth were diagnosed before treatment. Five (4.6 %) teeth were extracted maybe due to infection, acute apical periodontitis and perhaps lacking aseptic. Prostatic therapy in form of crown and bridge was performed in 22 (20 %) of cases. Radiographic images after 4 years were only available in 21 (19 %). (See table 2).

Eight teeth underwent one-visit endodontics, treatment which six teeth had pulpit and two teeth had necrosis pulp and apical periodontitis, 68 teeth after 2 visits, 22 after three and seven teeth after four and finally five teeth after five visits.

Rubber dam was used in 99 (90 %) during treatment but not throughout whole treatment. For example, some of these teeth have had rubber dam in cleaning session, some of them in the root-filling session and some of them in both session. In only 11 teeth (10 %) cases rubber dam was not used at any time.

The duration of intracanal antibacterial dressing (CaOH) as inter-appointment medicament varied between 0 up to 720 days with an average of 90 days.

The study shows that 35 (32 %) teeth had root- fillings length more than 2 mm from the apex, 24 (22 %) teeth had the length of root canal less or alike to 2 mm from the apex. In 27 (22 %) teeth, the root fillings have been followed the standards rule that is 1 mm from the apex. In 24 teeth could not assess the length of the root canal because of the lack of radiographs.
According to our study only 21 teeth (19 %) had radiograph after 4 years and the endodontic. The outcome is good for 10 (48 %) of the teeth and poor for 11 (52 %) of the teeth. In 89 (81 %) teeth could not assess the result because of the lack of information, e.g. radiograph.

**DISCUSSION**

Total 210 patients were included in our study. Of those 100 were excluded due to lack of documentation. This disappearance may affect the result due to smaller cohort. Of 110 teeth only 66 (60 %) teeth had primary diagnosis while 44 (40 %) teeth had no registered diagnosis. There may be a common relationship between the diagnosis and treatment then a correct diagnosis can lead to more successful treatment. The lack of diagnosis is one of the factors that can influence treatment outcomes and further prognosis.

In our study, eight teeth were treated during one-visit, which 2 of them had necrotic pulp with apical destruction and the rest 6 teeth had pulpitis diagnosis. The number of visits for these teeth has not affected the prognosis. One vs. two visits endodontic has been subject for some studies and majority of these have shown that there is no difference in the result of treated teeth with necrotic pulp during one or multi-visits, however one must consider definition of successful treatment. (Akbar et al., 2013: Figini et al., 2008)

Another striking finding was the lack of rubber dam usage. The use of rubber dam is necessary during root filling because if salivary bacteria get access to the root canal, they can cause a root canal treatment failure (Goldfein et al., 2013). It has been shown that use of rubber dam has a significant impact on treatment success (Lin et al., 2014). In our material a total of 11 (10 %) teeth were treated without rubber dam throughout the whole treatment of which one tooth extracted due to reinfection.

Furthermore, we noted that 22 (20 %) teeth have received the laboratory-produced crown and 88 (80 %) teeth have had traditional filing. This can affect the success of frequency in endodontic treatment, when the coronal restoration is preferred over traditional filling as it protects root treatment by preventing the bacteria to penetrate and re-infect (Trope and Ray, 1995). In other study has been shown the teeth which have given crown restorations 4 months
after root filling have been about 3 times greater to be extracted than teeth are given crown restorations during 4 months after root filling (Pratt et al., 2016).

The quality of root filling is another important factor as this may affect treatment results. Our study shows that 35 (32 %) teeth had root- fillings length > 2 mm from the apex and in 24 (22 %) teeth had the length of root canal less or equal to 2 mm from the apex. In 27 (22 %) teeth have seen that root filling is 1 mm from the apex, and finally in 24 (22 %) teeth could not assess the length of the root canal because of the lack of radiographs.

Compared with the results from another study show that the length of root filling between 0-2 mm has 94% successful frequency, however root fillings > 2 mm have 68% successful frequency (Sjögren, 1990). Thus, when the root filling is closer to the apex, the prognosis is better but a root filling short of apex decreases the prognosis for a positive outcome (Sjögren, 1990).

Generally, the root canal treatment fails when treatment is far from adequate standards and that leads to a negative outcome (Seltzer et al., 1963). According to Strindberg’s strict criteria, it takes up to four years to complete healing (Strindberg, 1956). In our study were only 21 (19 %) radiographic images available after 4 years. However, the lack of follow up x-ray images in our study makes it almost impossible to evaluate the outcome of the treated teeth.

In our study only 21 teeth (19 %) had radiograph after 4 years and 10 (48 %) of those showed good outcome according to Strindberg's criteria. It means prognosis for 89 (81 %) could not be determined.

In conclusion, we analyzed the factors, which might affect the success rate that achieved in root treatment in general dentistry. Lack of documentation in our material makes it very difficult and uncertain to identify such factors however there are some factors worth highlighting.
• Inadequate documentation.
• Deficiencies in pre-treatment diagnostics.
• Aseptic treatment e.g. rubber dam
• Failure in follow-up documentation of treated teeth
• Quality of root filing.

These factors can be improved by keep to standard criteria of root canal treatment and follow up patients after treatment progresses and to be more precisely in the journal documentation.

ACKNOWLEDGEMENTS

We would like to thank all persons who have contributed and helped us perform this work in the best possible way. A special thanks to our supervisor Majid Ebrahimi who has devoted his soul, time and valuable knowledge for guidance to this study. We also want to thank Folk tandvården in Västerbottens läns landsting and Ulf Söderström for providing us the material for this study. Last but not least we will also thank Anders Berglund for his valuable advices during this work.
REFERENCES


Table 1: Number of teeth originally and after exclusion.

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<th>Teeth</th>
<th>Molar</th>
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<td>72</td>
<td>52</td>
<td>210</td>
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<td>Excluded</td>
<td>42</td>
<td>41</td>
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Table 2: Overview of observed factors

<table>
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<td>Diagnosis</td>
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<td>Prosthetic</td>
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<td>Retreatment</td>
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<tr>
<td>Extraction</td>
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<tr>
<td>Radiograph of 4-year</td>
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