Prevalence and technical quality of root canal treatment in Sulaimani patients (A radiographic evaluation)

Raad S. Al-Marza B.D.S, M.Sc (1)
Ranj Adil B.D.S, M.Sc (2)

ABSTRACT
Background: This study was undertaken to examine the prevalence and technical quality of root canal treatment in Sulaimaniya subpopulation by using orthopantomographs.

Materials and methods: The panoramic radiographs of 704 Sulaimaniya adults attending the Dental College Hospital of the University of Sulaimaniya were examined for endodontic treatment technique and its association with periapical conditions.

Results: Out of the (704) cases examined, (40.7%) were endodontically treated. Periapical radiolucencies were found in (19.50%) of all endodontically treated teeth. More than (37.3%) of the root-filled teeth were scored inadequate on the basis of a criterion evaluating the level of the root canal filling.

Conclusion: The technical standard of root canal treatment in Sulaimaniya general dental clinics is disappointing. The findings indicate that there is still a substantial need for postgraduate endodontic education in Sulaimaniya and a need for specialists in endodontology.

Key words: Epidemiology, periapical diseases, radiographic evaluation, root canal treatment. J Bagh Coll Dentistry 2009; 21(2):54-58

INTRODUCTION
The main objective of endodontic therapy is to promote the chemo-mechanical cleansing of the entire pulp cavity and to perform its complete obturation with an inert filling material. The chemo-mechanical preparation plays an important role in removing pulpal (organic) and dentinal debris (inorganic), as well as micro-organisms from the root canal system. The preparation is mechanically performed using endodontic files and thoroughly irrigating the canal with an inert solution in order to remove debris. In addition, the canal must be chemically prepared using an auxiliary chemical substance or a combination of substances. The obturation of the entire root canal system, from crown to apex, is meant to eliminate empty spaces and to preserve the decontamination performed in the course of the chemo-mechanical cleansing step. An inadequate chemo-mechanical preparation and root canal filling associated with untreated and unfilled canal ramification because the dentist fails to recognize its presence (The dentist must have a thorough knowledge of root canal morphology before being able to successfully perform endodontic treatment, consequently, failure of the root canal treatment. Several follow-up studies have been performed on root canal treatment with success rates of more than 90% being common. (1-4)

Most of these studies reported data from endodontic specialists and university clinics. Unfortunately, the success rates in general practice are substantially lower, for example, 65–75% success is commonly reported (3,4). This discrepancy in success rates may reflect a difference in the quality of endodontic treatment performed, despite improvements to instruments and materials and advances in the understanding of the disease process. Epidemiological studies have documented the prevalence of apical periodontitis in various population groups in relation to the quality of endodontic treatment (Table 1). However, most of this data comes from studies completed in Scandinavia.

It is only in recent years that epidemiological information from other countries has become available. These studies highlight the high prevalence of periapical periodontitis, due to the large number of poorly performed root canal treatments (4). Studies on adult oral health have not yet been performed in Sulaimaniya. Furthermore, there is no information on the frequency or success rates of endodontic treatment and the frequency of apical periodontitis.

The aim of the present study was to evaluate the prevalence and quality of root canal treatment and to determine, using radiographic means, the prevalence of periapical radiolucencies in a Sulaimaniya subpopulation.

(1) Assistant lecturer, Conservative Department of Conservative, Dental College, Sulaimaniya University
(2) Assistant lecturer, Oral and Maxillofacial Radiology Department of Radiology, Dental College, Sulaimaniya University
Table 1: Prevalence of apical periodontitis and root canal fillings in previous studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>No. of teeth</th>
<th>% AP</th>
<th>% Endo</th>
<th>% Endo.</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>BergstroÈm et al.</td>
<td>1987</td>
<td>Sweden</td>
<td>6593</td>
<td>3.5</td>
<td>6.5</td>
<td>28.8</td>
<td>Subjects with regular dental care habits</td>
</tr>
<tr>
<td>Eckerbom et al.</td>
<td>1987</td>
<td>Sweden</td>
<td>4889</td>
<td>5.2</td>
<td>13.0</td>
<td>26.4</td>
<td>Patients from general practices</td>
</tr>
<tr>
<td>OÈdesjoÈ et al.</td>
<td>1990</td>
<td>Sweden</td>
<td>17430</td>
<td>2.9</td>
<td>8.6</td>
<td>24.5</td>
<td>General Swedish population</td>
</tr>
<tr>
<td>Eriksen &amp; Bjertness</td>
<td>1991</td>
<td>Norway</td>
<td>2940</td>
<td>3.5</td>
<td>6.0</td>
<td>36.6</td>
<td>50-year-old Oslo citizens</td>
</tr>
<tr>
<td>Imfield</td>
<td>2004</td>
<td>Switzerland</td>
<td>2040</td>
<td>8.4</td>
<td>20.3</td>
<td>31.0</td>
<td>66-year-old Zurich citizens</td>
</tr>
<tr>
<td>Erikson et al.</td>
<td>1995</td>
<td>Norway</td>
<td>2931</td>
<td>1.5</td>
<td>3.4</td>
<td>18.0</td>
<td>1973</td>
</tr>
<tr>
<td></td>
<td>1997</td>
<td>Norway</td>
<td>3917</td>
<td>1.4</td>
<td>3.4</td>
<td>25.6</td>
<td>1984 35-year-old Oslo citizens</td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>Norway</td>
<td>3282</td>
<td>0.6</td>
<td>1.3</td>
<td>38.1</td>
<td>1993</td>
</tr>
<tr>
<td>De Cleen et al.</td>
<td>1993</td>
<td>Netherlands</td>
<td>4196</td>
<td>6.0</td>
<td>2.3</td>
<td>39.2</td>
<td>Dental school patients</td>
</tr>
<tr>
<td>Buckley &amp; Spangberg</td>
<td>1995</td>
<td>USA</td>
<td>5972</td>
<td>4.1</td>
<td>5.5</td>
<td>31.3</td>
<td>Dental school patients</td>
</tr>
<tr>
<td>Weiger et al.</td>
<td>1997</td>
<td>Germany</td>
<td>7987</td>
<td>3.0</td>
<td>2.7</td>
<td>61.0</td>
<td>Individuals visiting a general dental surgery</td>
</tr>
<tr>
<td>Saunders et al.</td>
<td>1997</td>
<td>UK</td>
<td>8420</td>
<td>4.9</td>
<td>5.6</td>
<td>58.1</td>
<td>Dental hospital patients</td>
</tr>
<tr>
<td>Marques et al.</td>
<td>1998</td>
<td>Portugal</td>
<td>4446</td>
<td>2.0</td>
<td>1.5</td>
<td>21.7</td>
<td>30±39-year-old Porto citizens</td>
</tr>
</tbody>
</table>

% AP, percentage apical periodontitis; % Endo, percentage endodontically treated teeth; % Endo with AP, percentage endodontically treated teeth associated with apical periodontitis.

MATERIALS AND METHODS

Patient selection

Panoramic radiographs were obtained from 704 adult patients seeking care within the dental service provided by the dental college in Sulaimani University in the north of Iraq whose endodontic treatment was performed by general dental practitioners in Sulaimaniya city during 2008. Patients younger than 18 were excluded. All x-ray films were taken by radiologist using a planmeca praline panoramic x-ray with DIMAX 3.0, serial no. (RCC034898) manufactured by Planmeca OY 00880, Finland. All panoramic radiographs selected for the present study were taken in the same year (2008) are taken during the treatment purpose in different dentistry branches in the Dental College Hospital of the University of Sulaimaniya and after that the panoramic radiographs studied in order to check the frequency and the quality of the root canal treatment technique.

Radiographic examination

All radiographs were evaluated under optimal conditions where the surrounding light could be controlled for the best possible radiographic contrast. The radiographs were placed on a viewing box and light surrounding the radiograph was blocked. The radiographs were examined using an x-ray viewer and magnifying lens (X 3).

The criteria for the radiographic categorization of all teeth were as follows (5):
- Root canal filling 0–2 mm short of the radiographic apex (adequate)
- Root canal filling >2 mm short of the radiographic apex (inadequate)
- Root canal filling extruded beyond the radiographic apex (inadequate)
- Root canal filling limited to the pulp chamber (inadequate).

RESULTS

A total of 6718 teeth were examined, teeth in the maxilla were more frequently root-filled (11.4%) as compared to those in the mandible (5.3). The highest incidence of root canal treatment was scored for the maxillary central incisors and maxillary first premolar; the teeth with the lowest incidence of root canal treatment were the mandibular central incisors and mandibular canines.

The quality of root canal treatment technique is shown in Figure 1. An acceptable standard of treatment was found in (62.7%) and unacceptable standard of treatment was found in (37.3%).

A post was seen in (18.1%) of the root-filled canals, with (38.8%) of these cases associated with periapical pathology.

From the data and the examination of the (OPGs) revealed that the prevalence of apical periodontitis in association with endodontic treatment (19.5%) was higher than that without root canal treatment (1.7%).

Pathology was present least often in teeth with an adequate root canal filling. Furthermore, teeth with adequate root fillings had less pathology than teeth with root fillings more than 2 mm from the radiographic apex.

From the data in table 2 revealed that an anterior filled roots existed in (40.3%) of which (28.2%) scored unacceptable, and a posterior filled roots existed in (59.7%), of which (43.5%) scored unacceptable, were (71.7%) of anterior and (56.5%) of posterior teeth scored acceptable.

The periapical conditions of the unacceptable endodontic treatment cases are
shown in figure 2 apical periodontitis was periapical pathology in (80.4%).

Figure 1: Quality of root canal treatment technique

Figure 2: periapical conditions of the unacceptable endodontic treatment

Table 2: quality of endodontic treatment in anterior and posterior teeth

<table>
<thead>
<tr>
<th></th>
<th>Acceptable endodontic treatment</th>
<th>Unacceptable endodontic Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior teeth (40.3%)</td>
<td>71.7%</td>
<td>28.2%</td>
</tr>
<tr>
<td>Posterior teeth (59.7%)</td>
<td>56.5%</td>
<td>43.5%</td>
</tr>
</tbody>
</table>

Figure 2: quality of endodontic treatment in anterior and posterior teeth
DISCUSSION

Digital OPG was employed to examine all patients for the purpose of standardization. They stated that the use of panoramic radiography in epidemiological studies of dental health was acceptable. They found a high specificity and sensitivity of 86–96% for the detection of periapical pathology on OPG compared with full mouth surveys. In addition, modern panoramic machines produce better radiographic quality, even in the anterior region (6). They found that a periapical survey revealed more radiolucencies than a panoramic survey, sensitivity of 86–96% for the detection of periapical pathology on OPG compared with full mouth surveys. In addition, modern panoramic machines produce better radiographic quality, even in the anterior region (7).

They found that a periapical survey revealed more radiolucencies than a panoramic survey, although the difference was not statistically significant (7). The under estimation in scoring periapical lesions on OPGs of good quality is thus low, and the validity of evaluating the periapical conditions on OPG is reliable. This is also confirmed by more recent evaluations of the specificity for detecting periapical lesions on OPG (8,9). The quality of endodontic treatment was disappointing, with 37.3% of root fillings being inadequate. In this respect, the data confirm the findings of several other investigators showing inadequate of root canal treatment (10-17). Although the parameters used to score endodontic quality were not the same for all of these studies, the conclusion must be that the quality of endodontic treatment was poor. High technical standards during root canal treatment remains the key for success and for a good long-term prognosis (2,13). Moreover, it has been proven that the association of endodontic treatment with apical periodontitis decreases when root canal fillings are within 2 mm of the radiographic apex (2). In the present study, only (27.9%) of teeth with root fillings more than 2 mm from the radiographic apex had a normal periodontal ligament. Those at or within 2 mm of the radiographic apex had a normal radiographic ligament space in (62.7%) of cases. Root fillings extending beyond the radiographic apex and fillings limited to the pulp chamber gave the poorest results, an outcome reported in several other studies (2,10-12).

The density of the root fillings was not evaluated in the present study as it is difficult to score on an OPG. Endodontic success is found on three fundamental principles: cleaning, shaping and filling. Only the last parameter can be scored partially on radiographs. In this respect, they found no statistical difference between compact and poorly compacted root fillings in relation to periapical lesions (13,18). However, they stated that the homogeneity of the root filling was associated with a lower frequency of periapical lesions more so than the length of obturation (15). Finally, they found that incompletely obturated root-filled teeth developed periapical lesions significantly more often than completely obturated root canals (19).

Root-filled teeth in our study had periapical pathology present in (19.5%) of cases, 10 times higher than on teeth without root fillings (1.7%). From the periapical lesions seen on a radiograph it is not possible to determine whether or not it is healing. In this respect, they found that after a 10-year period the number of healed periapical lesions was equal to the number of newly developed lesions, indicating the reliability of cross-sectional studies for scoring the long-term success of endodontic treatment (19). The results are also supported by data reported by other study (20). Furthermore, it should not be forgotten that periapical lesions are not always detected radiographically. Lesions limited to cancellous bone are almost impossible to detect with conventional radiographic techniques (21-23), including panoramic radiographs. They determined that 7.1% MBL (mineral bone loss) was a minimum for detecting a lesion on a radiograph in vitro. The MBL in vivo is estimated at 30–50% due to the superposition of tissue and fluid. This makes it necessary for a lesion to affect the cortical bone in order for changes to occur radiographically. The prevalence of periapical radioluencies in this study must thereby be an underestimation of the real situation (22).

The quality of endodontic treatment is of major influence for root canal treatment. Controlled studies have shown high success rates (1-4). The low success rates in general practice are most probably attributable to the persistence or introduction of micro organisms and their metabolic products in the root canal system and periradicular tissues (11,12,24). The use of leaking temporary filling materials is another factor of major concern. Inhibition of coronal leakage between appointments must be emphasized more and further consideration must be given to sealing access cavities with glass ionomer cement. Finally, coupled with poor permanent coronal restorations, poorly performed root fillings will enhance the processes of infection and reinfection, which are essential for the maintenance or induction of periradicular disease.
REFERENCES


