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Periapical status and quality of root fillings in a selected adult Riga population

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SUMMARY

Aim. The aim of the study was to assess the prevalence of apical periodontitis and quality of root canal fillings in an adult Riga subpopulation.

Materials and methods. Panoramic radiographs of Latvian adults 35-44 year old attending a private dental clinic for the first time during the period of 2004-2008 were included in the study. Totally, 312 out of 1248 panoramic radiographs were randomly selected and examined for periapical conditions and endodontic treatment quality. The technical quality of root fillings was evaluated in terms of length in relation to the root apex and lateral adaptation to the canal wall. The periapical status was assessed using the PAI index.

The data were analyzed using SPSS 14 computer software program. Statistical significance was assessed by the chi-squared (Pearson's) test.

Results. Out of the 312 individuals examined 224 (72%) had one or more teeth with apical periodontitis (PAI 3-5) and 272 individuals (87%) had one or more endodontically treated teeth. Amongst 7065 teeth evaluated 1255 (18%) were endodontically treated. Only 285 teeth (23%) of the root canal treated teeth were with complete root canal fillings. There was a statistically significant relationship between quality of root canal fillings and apical periodontitis ($p<0.0001$). In teeth with complete fillings only 15% were with apical periodontitis, but apical periodontitis were detected in 342 teeth (35%) with incomplete root fillings.

Conclusion. The results from this study indicates a high prevalence of apical periodontitis and low quality of root fillings in a selected adult Riga population.

Key words: apical periodontitis, quality of root fillings, epidemiology.

INTRODUCTION

Apical periodontitis is an acute or chronic inflammation process around apex of the tooth. The main cause of apical periodontitis is bacterial invasion and colonisation of the root canal penetrating into the periapical tissues. Apical periodontitis usually develops after necrosis of the pulp (1) and is frequently detected in connection with endodontically treated teeth (2-5). The prognosis for teeth with apical periodontitis to heal completely after conventional root canal treatment is 73-86% (6, 7). This success rate is obtained by highly trained clinicians under strict conditions, usually not reflecting the situation in general dental practices (8) where the success rate is down to 60-75% (6, 9). This difference in outcome depends on the quality of various procedures related to proper root canal treatment (6, 10-15).

Based on epidemiological studies, apical periodontitis is a prevalent disease in Europe (16). Most of the endodontic epidemiological studies are from Scandinavian countries and the prevalence is reported to be between 30 and 60% and increasing with increasing age (4, 9, 17-19). Outside Scandinavia, the reported prevalence is also varying. In a Portuguese population Marques et al. (20) reported a prevalence of 27% while the prevalence in a Lithuanian population was found to be 70% (21, 22). In Belgium De Moor et al. (23) found a prevalence of apical periodontitis of 63%. Similar findings are reported from Spain (24, 25), Turkey (26) Morocco (13), Belarus (27), Jordan (10). Epidemiological

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studies confirm that high prevalence of apical periodontitis is associated with low quality root canal treatment (9, 26, 28-30).

There are no epidemiological oral health studies or data about the prevalence of apical periodontitis and frequency and success of endodontic treatment in Latvia. The aim of the present study is therefore to study the prevalence of apical peridontitis and quality of root fillings in adult Latvians. Due to difficulties related to a random sampling, patients attending a private dental clinic in Riga were used.

MATERIALS AND METHODS

Patients aged 35 to 44 and voluntary consulting a private dental clinic (ARK) in Riga, Latvia for the first time from January 2004 till January 2008 were included in the study. The evaluation was performed based on digital orthopantomograms (OPG's) and 1248 patients were retrieved and listed alphabethically. Every fourth was selected and if the selected patient did not have an OPG, the next one on the list was chosen. A total of 312 patients were included in the study.

All OPG's were taken with Sorendex Cranex Excel D Model SL-4/PT11 x-ray. Endodontically treated teeth, teeth with apical periodontitis and missing teeth were identified from the OPG's. The radiographs were examined by one examiner (IJ) and third molars and teeth that could not be assessed due to inferior quality were excluded. In order to assess the periapical conditions, the periapical index (PAI) (31) was used. Apical periodontitis was assigned to the tooth for PAI scores 3, 4 and 5 while normal apical conditions were scored for PAI values 1 and 2 (Table 1). If a tooth had more than one root PAI value was allocated to the highest PAI score (worst root).

The technical quality of the root fillings was evaluated according to length from the root apex and homogeneity (adaptation to the canal walls, voids and porosities) using a modified version of Petersson's criteria (32). "Complete filling" was assigned for a homogeneous filling finishing 0-2 mm from radiographic apex. "Incomplete root filling" was recorded if the filling terminated more than 2 mm from radiographic or extending beyond radiographic apex and/or showing voids and porosities. Pulpotomy was registered separate in cases where endodontic material was observed only in the coronal part of the pulp (Table 1).

Regarding PAI, intra-examiner reproducability was performed using 100 digital periapical radiographic images scoring twice to reach the „Silver standard" (31). To evaluate root canal filling quality, periapical radiograms of 45 endodontically treated teeth were used. Intra-examiner agreement regarding PAI scores and inter-examiner agreement for quality of root canal filling was assessed using Cohen's kappa coefficient. For PAI scores, a kappa value of 0.8 was registered and for root filling quality (length and density), the kappa value was 0.7, indicating good examiner agreement.

Table 1. Criteria used for recording quality of root canal fillings and PAI scores

Quality of root filling	Complete: Terminating 0-2mm from apex, no voids or porosities Incomplete: Terminating > 2mm from- or extending beyond apex with or without voids and/or porosities Pulpotomy: Endodontic material only in coronal pulp chamber
Periapical index (PAI) (Orstavik et al. 1986)	1. Normal periapical structures 2. Small changes in periapical bone structures 3. Changes in periapical bone structures with some mineral loss 4. Apical periodontitis with well defined border line 5. Apical periodontitis with exacerbation features

Table 2. Prevalence of apical periodontitis and endodontically treated teeth

Number of individuals	312 (100%)
Individuals with endodontically treated teeth	272 (87%)
Individuals with apical periodontitis (PAI>2)	224 (72%)
Number of teeth evaluated	7065 (100%)
Teeth with apical periodontitis	502 (7%)
Endodontically treated teeth	1255 (18%)
Root filled teth with apical periodontitis	384 (31%)
Pulpotomised teeth	57 (5%)
Pulpotomised teeth with apical periodontitis	28 (49%)

Table 3. Relation between the technical quality or root canal fillings and apical periodontitis

Quality of root fillings	With apical periodontitis n (%)	Without apical periodontitis n (%)	Total n
Complete	42 (15)	243 (85)	285 (100)
Incomplete	342 (35)	628 (65)	970 (100)
Total	384	871	1255

χ^2=43.68, OR=3.2 (2.1-4.5), P<0.0001.

The data were analyzed using SPSS 14 computer software program. Statistical significance was assessed by the chi-square (Pearson) test; p-values less than 0.05 were considered statistically significant.

RESULTS

A total number of 7490 teeth was examined, an average of 24 teeth per person. From the total number, 425 were excluded due to improper radiographic quality and third molars were excluded leaving a total of 7065 teeth available for evaluation. Prevalence of apical periodontitis and number of endodontically treated teeth is presented in Table 2.

Out of the 312 individuals examined 224 (72%) had one or more teeth with apical periodontitis (PAI scores 3-5) and 272 individuals (87%) had one or more endodontically treated teeth. Out of 7065 teeth evaluated, 502 teeth (7%) had apical periodontitis. Of the teeth diagnosed with apical periodontitis, 384 (76%) were root filled, 28 (6%) pulpotomised and 90 (18%) were not root filled. Out of all teeth evaluated, 1255 (18%) were endodontically treated and 1245 teeth were missing. Almost half of the 57 pulpotomized teeth 28 (49%) had apical periodontitis.

Out of the 1255 endodontically treated teeth evaluated, only 285 teeth (23%) were with complete root canal fillings, a homogeneous filling finishing 0-2 mm from radiographic apex . In 970 teeth (77%), the root canal fillings were considered incomplete. There was a statistical significant relationship between quality of root fillings and presence of apical periodontitis. In the 285 cases with complete filling, only 42 teeth (15%) were recorded with apical periodontitis, but apical periodontitis were detected in 342 teeth (35%) with incomplete root filling. The relation between radiographic quality of root fillings and apical periodontitis is shown in Table 3.

DISCUSSION

The present study is retrospective and performed on a selected, adult population attending a large, private clinic in Riga, Latvia. A private "ARK" clinic was chosen, in part due to difficulties in access to public statistics for a random selection and in part because radiographs were readily available. Patients attending the "ARK" clinic for the first time and aged 35 to 44 years represent the selected group. We are aware that this represents a limitation compared to a randomly selected cohort representing all 35 to 44 years old from Riga. The results may therefore be considered as an estimate of the real condition and not being generalized.

A wide variation in the design, sample selection, radiographic registration methods, criteria for recording periapical lesions and quality of root fillings have been used in previous endodontic studies. A direct comparison is therefore in many instances difficult. Our data indicate that 87% of the individuals included in the study had one or two endodontically treated teeth. This figure indicates that root canal treatment is prevalent among young adults in Riga. A similar result (84%) has been recorded from the same age group from Lithuania (21) while Skudutyte-Rysstad & Eriksen (33) reported only 23% of 35-years-olds from Oslo, Norway with endodontically treated teeth. A study on patients attending a university dental clinic in Belgium showed 63% (23) while a lower figure 47% was presented from a similar study in Turkey (36). From this survey, it might be concluded that the prevalence of endodontic treatment is high in the Baltic countries (Latvia, Lithuania) compared to other societies.

The prevalence of apical periodontitis was also high in this selected group of patients (72%). This is similar to the figures from Lithuania (70%) (21) and even higher prevalence of apical periodontitis were presented from a study in Belarus (85%) (27). On the other hand, low prevalence of apical periodontitis was found in a 30-39-year-old Portuguese population (27%) (20) and even lower prevalence (16%) was found in a Norwegian population of young adults (33).

Out of all evaluated teeth, we found 7% with apical periodontitis. Only two studies have shown higher figures, Kabak and Abbott (27) 12% and Sidaravicius et al. (21) 7.2%. In studies from Denmark only 1.8% (4), from Portugal 2.0% (20) and from patients aged 35 to 44 years attending a university dental clinic in Ireland, 2.2% of all evaluated teeth was found with apical periodontitis (34). The information presented regarding prevalence of apical periodontitis indicates that this condition is most prevalent in Eastern European countries.

In our sample, 18% of the teeth where endodontically treated. Kabak and Abott (27) reported 20% teeth from Belarus with filling material in the root canals. Two studies from Lithuania shoved comparable results. Sidaravicus et al. (21) found 15% of all teeth being endodontically treated in a comprehensive oral health study on 33 to 44 year old individuals from the Vilnius region and Peculiene et al. (35) found 13% of endodontically treated out of all functional teeth in a sample of 83 subjects attending the Institute of Stomatology in Vilnius. However, studies from Western Europe indicate much lower figures (4, 33, 34). This difference may

be explained by higher caries prevalence and less regular treatment habits in Latvia.

Among all endodontically treated teeth, 31% presented with apical periodontitis and almost half of the pulpotomised teeth had apical periodontitis. This result is comparable with data from the same age group in Vilnius (21) where the prevalence of apical periodontitis in root filled teeth was 35% and in pulpotomised teeth 44%.

Presence of apical periodontitis in root filled teeth correlates with the technical quality of the root fillings (Table 3). This is supported by Petersson et al. (3) who found that incompletely obturated, root-filled teeth developed apical periodontitis significantly more frequent than teeth with completely obturated root canals. Seventy seven percent of the root fillings in the present study were considered incomplete and apical periodontitis were recorded in 35% of these teeth while only 15% of the completely obturated roots presented with apical periodontitis. Such relation is documented from many epidemiological studies (5, 20, 21, 34).

CONCLUSION

This study indicates a high prevalence of apical periodontitis and low quality of root fillings in a selected adult Riga population. Endodontic problems seem to be more prevalent in Latvia and other Eastern European countries compared with countries in Western Europe. To evaluate the true prevalence of apical periodontitis in the population of Riga, a randomized epidemiological study is necessary.

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