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Survival of endodontically treated teeth with severe periodontal involvement

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The endo-perio lesion may be defined as an infrabony, marginal pocket communicating with an inflammation of pulpal origin. In clinical practice, a separate endodontic and periodontal diagnosis is made, whereas treatment outcome eventually confirms the diagnosis of an endo-perio lesion. The treatment prognosis of such teeth is poorly understood, due to diagnostic uncertainties. The purpose of this study was to assess the 2-year survival of teeth with an endo-perio diagnosis. A total of 3,700 cases were reviewed. Inclusion criteria for the test group were teeth that had been endodontically treated for a pulpal/apical condition and showed severe periodontal involvement with pocket depth ≥ 6 mm and/or furcation involvement. Exclusion criteria were file or root fracture, accidental perforation to the periodontium during an endodontic procedure, and internal or external root resorption. One hundred teeth that had been endodontically treated due to pulp necrosis, pulpitis and/or apical periodontitis without any periodontal involvement were used as a control group. One hundred and thirty-four teeth complied with the inclusion criteria. The results showed that 20/134 (15%) of teeth in the test group had been extracted after 1 year and 25/134 (19%) after 2 years. The extraction rate was significantly higher for teeth with chronic apical periodontitis (27%), as compared with teeth without an apical lesion (10%). None of the control teeth had been extracted after 2 years. Periodontally involved teeth are at high risk of being extracted after endodontic therapy, and the risk increases with increasing severity of the endodontic diagnosis.

■ Introduction

The dental pulp and the periodontium are closely related in health as well as in disease. The pulp originates from the dental papilla and the periodontal ligament derives from the dental follicle, only separated by Hertwig's root sheath. As the tooth matures and the root develops, communications are created between them by dentinal tubules, lateral and accessory canals and the apical foramina. These communications may carry information in health, but also irritants and infectious material in disease. If an area

of infection is formed combining these two compartments, it is called a combined endo-perio lesion. Based on its origin, such a combined infection may be (1) a 'primary endodontic disease with secondary periodontal involvement', (2) a 'primary periodontal disease with secondary endodontic involvement' or (3) a 'true combined disease'[1].

In the first case (1), a primary endodontic lesion has created a sinus tract draining coronally through the periodontal ligament to the marginal pocket. Such a newly formed sinus tract is a very narrow and slender canal and very unlike the wide periodontal pocket starting from the marginal area in periodontal lesions. With time, marginal inflammation may become established in the coronal end of the sinus tract, and thereafter may extend deeper thereby widening it to a more 'periodontitis-like' lesion, or a periodontal pocket. The combined lesion is thus primarily a sinus tract originating from the apical area or infected lateral/accessory canals that is secondarily widened by a periodontal lesion from the marginal area. This may also happen with inter-radicular canals communicating the pulpal chamber in multi-rooted teeth with the corresponding furcation area, resulting in a periodontal furcation diagnosis. In the second case (2), a periodontal lesion, or pocket, extends apically along the root from the marginal area. As this lesion reaches accessory canals or the apical foramina, the canals are thought to become infected, eventually leading to a secondary infection of the pulp itself. The combined lesion is thus primarily a periodontal lesion extending from the marginal area that infects the still vital pulpal tissues through the above mentioned communication canals. However, many authors are sceptical about such infectious pathways[2–5]. On the other hand, the finding that many of the same bacterial species are involved in the two diseases may indicate that there is a communication between the infectious conditions[6,7]. The true combined diseases (3) are less frequent and occur when a pulpal lesion presents itself to the periodontium via the apical foramina, lateral canals or in furcation areas, progresses coronally and eventually joins with an infected marginal periodontal pocket, which progresses apically[8,9]. The combined lesion is thus created when the two lesions of independent origin (1 and 2) meet.

In most cases of endo-perio lesions, one expects to find an infected, necrotic pulp. Thus, the finding of a pulp sensitive to electrical or thermal pulp tests would normally rule out the diagnosis. However, there will be cases of partial necrosis where, for example, a multi-rooted tooth shows sensitivity despite being infected in one of its root canals.

Thus, an endo-perio lesion may be defined as a periodontally involved tooth with pulp necrosis and infection where the necrosis may be partial, involving only parts of the pulp, or total, involving all pulpal tissues extending from the pulpal chamber to the foramen.

Communicating canals between the pulp and the periodontium in the coronal third of the root are seen in 1–5% of single-rooted teeth. In the mid-third section, 7–10% of single-rooted teeth show such canals, whereas 15–20% of such teeth show these communications in the apical third[10]. Twenty to twenty-five per cent of multi-rooted teeth show accessory canals from the pulp to the furcation area[10–12]. The endo-perio lesion is dependent on the infectious communication between the pulp and the periodontium irrespective of its location on the root surface, and not only in the cases where the apical foramina are involved and the periodontal pocket extends to the apex of the tooth.

The diagnosis of endo-perio lesions, as well as the prognosis of their treatment, are not generally agreed upon or well understood. Irrespective of the original source of the underlying infection, treatment is difficult, time consuming and expensive. A sound prognostic evaluation is therefore needed before embarking upon a combination therapy project. Thus, the aim of the present study was to assess the 2-year survival of teeth with combined lesions subject to endodontic and periodontal therapy.

■ Materials and methods

All patient records (3,700) from 1997 to 2003 from the Department of Endodontics, Faculty of Dentistry, University of Oslo, Norway, were manually searched for cases suggestive of an endo-perio diagnosis. Parameters recorded were age of patient, gender, tooth number, periodontal pocket depth measured by a graded periodontal probe, furcation involvement as described in charts and assessed on radiographs, endodontic diagnosis, and extraction or retention of the tooth during a 2-year follow up.

Inclusion criteria

- Pocket depth ≥ 6 mm and/or furcation involvement
- Endodontic diagnosis of total pulpal necrosis or partial necrosis with pulpal inflammation
- Endodontic treatment according to a standard protocol for necrotic and infected teeth
- Follow-up of more than 2 years or if extracted, the time of extraction.

Exclusion criteria

- Fractured file in root canal integrated in the endodontic filling
- Root fracture/infraction of the tooth
- Perforation to the periodontal ligament during endodontic treatment
- Presence of root resorption during treatment or the follow-up period.

One hundred and thirty-four teeth were identified by the inclusion and exclusion criteria.

Table 1 Survival of teeth in test and control groups, and in substrata of the test group.

	Diagnosis	Number	Retained (%)
	Control group	100	100.0
	Endo-perio lesions	134	81.3
1	Chronic apical periodontitis	53	73.6
2	Chronic apical periodontitis with sinus tract	6	66.7
	1 + 2	59	72.9
3	Normal apical periodontium	39	87.2
4	Acute apical periodontitis[#]	23	95.7
	3 + 4	62	90.3
5*	Pocket depth = 6 mm	31	87.1
6*	Pocket depth > 6 mm	62	71.0
7*	Furcation: grade III	12	75.0
8*	Maxillary first premolars	15	66.7

** Insufficient data for analysis of significance*
[#] Groups 1 + 2 versus 3 + 4: statistically significant difference ($p < 0.05$).

Controls

Controls were a random selection of 100 endodontically treated teeth based on the same inclusion and exclusion criteria, except that they had no periodontal diagnosis. The control teeth came from the same archives and time period as the test group.

Outcome descriptor and statistics

The outcome was scored as retention of the tooth (tooth survival). The teeth were grouped and compared according to tooth type, type and extent of periodontal involvement and endodontic preoperative diagnosis. The results were analysed with Fisher's exact 2-sided test and the chi-square test with a 5% significance level using the tooth as the statistical unit.

Results

Of the 134 test teeth, 25 teeth (18.7%) were extracted within 2 years of treatment ($p < 0.05$). Of these extractions, 20 were performed within 1 year of treatment. None of the control teeth were extracted within the same time span.

Impact of the endodontic diagnosis

Significantly more teeth (27%) that had the radiographic diagnosis of chronic apical periodontitis (with or without a sinus tract) were extracted compared to teeth with no radiographic signs of apical periodontitis (10%) (Table 1).

Impact of the periodontal diagnosis

A trend was found in which there were more extractions among the test teeth showing periodontal pocket depths > 6 mm than those = 6 mm. Of 31 teeth showing periodontal pocket depths = 6 mm, 4 (12.9%) were extracted, whereas of 62 teeth showing periodontal pocket depths > 6 mm, 18 (29%) were extracted within the first 2 years of treatment. Of teeth with grade III furcation lesions, 3 out of 12 (25%) were extracted. Moreover, the maxillary first

premolars appeared to have a less favourable prognosis than any other teeth in the study (Table 1). No other registered parameter had any influence on the survival of teeth with combined lesions treated in the described manner.

■ Discussion

This study is a retrospective case-control study, which has several limitations, and conclusions must be drawn with caution. A double-blind intervention study would be of great interest and of higher value, but an intervention project warrants a pilot investigation, especially because the diagnostic criteria are so uncertain. Moreover, the endo-perio lesion deserves further study since therapy is expensive and time-consuming and few prognostic evaluations have been published so far. While the present study has discussed the endo-perio lesion according to accepted clinical terms, it must be recognised that the chairside diagnosis is a combination of two separate diagnostic entities: pulpo-periodontal inflammation and marginally derived periodontitis. Therefore, an attempt has been made to clarify and broaden the definition as understood by both the endodontist and the periodontist from their separate clinical standpoints.

As there are no definitive criteria for an endo-perio diagnosis, a set of separate, endodontic and periodontal descriptors were chosen to select cases that would logically include such lesions. The primary criterion for case selection was the periodontal status. Teeth with furcation involvement were included, based on the presence of multiple and at times large communicating canals in this area. The second criterion was teeth with pocket depths ≥ 6 mm. This depth was chosen because more shallow pockets would not be likely to affect lateral canals to the same degree, and because teeth with shallow pockets with undetected or persisting pulpal communication would not likely be subject to extraction in the 2-year follow-up period. Although a wide selection, the two groups together constituted a panorama of periodontal cases that often raises questions about possible endodontic involvement. Traditionally, the periodontist identifies an endo-perio lesion if a slender, infrabony pocket extends to the apex of a totally necrotic tooth. The diagnosis is verified by a full or partial regeneration of the periodontal pocket following endodontic treatment. However, the present selection has widened this understanding to also include partial necrotic pulps and pockets not extending all the way to the apex.

The endodontic diagnosis was the secondary criterion. It included necrotic and infected teeth with chronic apical periodontitis and teeth with pulpitis, suggestive of initial infection of the pulp space and partial necrosis. Thus all the teeth selected had a pulpal condition that might affect the adjoining, marginal structures.

As discussed above, the endo-perio lesions cannot always be accurately diagnosed preoperatively. The diagnosis is confirmed when endodontic treatment leads to an improvement or at least a stabilisation of the marginal periodontal conditions. The actual periodontal outcome was not assessed in the present study since tooth survival was regarded as a more robust and practical means of measuring treatment outcome[13]. While the data did not permit a strict analysis of the causes of tooth extraction, it may be assumed that they were primarily related to the periodontal conditions, inasmuch as no tooth in the control group of identical endodontic preoperative status was lost.

■ Clinical considerations

With the above criteria for case selection, we found that almost 20% of all teeth with a combined endodontic and periodontal diagnosis were extracted within 2 years after endodontic treatment. In cases from the control group of similar endodontic preoperative condition, no extractions were performed.

Within the test group it appeared that when there was a normal apical periodontium (which included symptomatic apical periodontitis, pulp inflammation or pulp necrosis) preoperatively, the teeth had a better prognosis than if the endodontic diagnosis was one of chronic (asymptomatic) apical periodontitis, with or without a sinus tract. The differential prognosis for teeth with and without radiographic signs of apical periodontitis is well known from endodontic follow-up studies, where

the final outcome after one to several years is much better for teeth without preoperative lesions[14]. An explanation for this is that asymptomatic, chronic apical periodontitis may pass unnoticed for a long time and the infection may spread to areas difficult to reach mechanically or chemically because the infectious material, microorganisms and cells will have infiltrated the area completely. This may produce a more complex infection, both anatomically and microbiologically, and thus a less favourable prognosis for treatment.

Although not statistically significant, it appeared that the deeper the pocket, the more uncertain the prognosis seemed to become. Thus the presence of severe periodontal disease seemed to further reduce the survival rate of the teeth in the test group, although these particular data did not permit conclusions based on statistical significance. Also, a shallow periodontal pocket has less likelihood than a deep one to communicate with the infected or necrotic pulp. This corroborates earlier studies of endodontic treatment outcomes in periodontally involved teeth[15].

All treatments were provided by dental students or specialist candidates under the supervision of specialists in endo- and periodontics. The survival rate for this type of treatment in the control teeth was 100%, reflecting the general level of quality in terms of endodontic treatment outcome. Periodontal treatment followed a standardised regimen where pockets deeper than 6 mm were treated surgically. This is because studies have shown that following closed scaling and root planing in pockets deeper than 5mm, a majority of the treated root surfaces showed residual calculus and plaque[16]. However, in the described endo-perio cases, periodontal treatment was always provided more than 3 months following endodontic therapy in order to let the apical portions of a sinus tract heal spontaneously. Similar to the case with apical periodontitis, the local infection is not easily controlled, which can explain why teeth with pocket depths > 6 mm seem to have a less favourable 2-year prognosis compared to those = 6 mm.

Clinical recommendations

Treatment-resistant marginal periodontitis in combination with a necrotic, infected pulp constitute the simple, uncontroversial endo-perio lesion. Here, endodontic treatment is provided first, and there should be a waiting period of more than 3 months before subgingival scaling of the corresponding pocket. However, sometimes cases emerge where a periodontist diagnoses a tooth too severely involved to be retained by periodontal treatment, but suspects a partial endodontic involvement despite a positive reaction to electrical or physical stimuli. An endo-perio situation is then possible only if there is partial necrosis/infection of the pulp; this is virtually impossible to diagnose with any degree of certainty. When such a tooth is a crucial part of a prosthetic construction or in other ways important for the patient's oral health, and the periodontist regards the tooth as lost because the periodontal involvement is too severe, *endodontic treatment on periodontal indications may be warranted*. Following patient consultation and consent, opening of the pulp is then performed. The opening of the pulp will give the definitive endodontic diagnosis and if clearly vital, the tooth may be extracted on periodontal indications. On the other hand, if the pulp shows signs of reduced vitality, root canal treatment with an intracanal dressing is carried out with the intention of removing any possible source of continued infection that negatively affects the periodontal condition. A permanent root filling may be deferred until an eventual improvement in the periodontal conditions; should there be no positive influence of the root canal procedure, alternative treatment, most likely extraction, is indicated. This strategy provides an open-minded, yet clinically sound attempt to save the tooth as an endodontic diagnosis may be given by clinical insight into the pulp in a tooth that would have been extracted based on periodontal indications. It must be emphasised that these cases are uncommon.

In summary, the results of the present study confirm that periodontally compromised teeth are at high risk of being extracted shortly after endodontic treatment. Moreover, careful case selection and evaluation of alternative treatments, including extraction, are necessary before subjecting such teeth to extensive endodontic and restorative treatment.

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