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Interproximal bone loss at contra-lateral teeth with and without root canal filling in periodontitis patients

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Abstract

Aim: The purpose of this study was to test the hypothesis that teeth that are adequately endodontically treated develop more periodontal bone loss than their contra-lateral counterpart without root canal filling (RCF) in relation to the restoration margin (RM) in periodontitis patients.

Methods: In 53 periodontitis patients (26 females; 34–73 years of age), 66 pairs of radiographs were sampled. Each pair of radiographs depicted one pair of contra-lateral teeth: one with and one without RCF. All radiographs were digitized. Using a PC program the linear distances cemento-enamel junction (CEJ) or RM to the alveolar crest (AC) and CEJ/RM to bony defect (BD) were measured at the site of most pronounced bone loss. Comparisons were made according to RCF, RM, site (mesial/distal), jaw and tooth type (anterior/posterior).

Results: The study showed statistically significant differences for the distance CEJ/RM–BD only for tooth type (anterior: 6.17 ± 3.01 mm, posterior: 5.03 ± 2.59 mm, $p = 0.044$; without RCF: 5.14 ± 2.82 mm, RCF: 5.57 ± 2.70 mm, $p = 0.159$; without RM: 5.67 ± 2.98 mm, RM: 5.16 ± 2.61 mm; $p = 0.322$; mesial: 5.62 ± 2.98 mm, distal: 5.06 ± 2.24 mm; $p = 0.238$; maxilla: 5.55 ± 3.04 mm, mandible: 5.20 ± 2.52 mm; $p = 0.486$).

Conclusions: Teeth with endodontic treatment failed to exhibit more bone loss than endodontically untreated teeth.

Key words: computer assisted; diagnostic X-ray; periodontal bone loss; periodontitis; radiographic image interpretation; radiology; root canal treatment

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Periodontitis is a chronic inflammatory disease resulting in the destruction of connective tissue and bone support of teeth. A necessary element to induce periodontitis is microbial plaque that, after 3 weeks, will cause gingival inflammation, i.e. gingivitis (Löe et al. 1965). In the aetiology of periodontitis, a microbial biofilm is necessary, but not sufficient to cause destruction (Löe et al. 1986). To destabilize the protective inflammation and to cause destruction, further factors are necessary, e.g. defective host response, smoking (Tomar & Asma 2000), diabetes (Emrich et al. 1993) and psychosocial stress (Genco et al. 1999).

Besides patient level or systemic periodontal risk factors, tooth- and site-specific factors may locally increase the risk for and the severity of periodontitis, e.g. restoration margins (RMs) (Lang et al. 1983, Wang et al. 1993). Overhanging RMs provide niches for bacterial colonization and conditions for a shift within the microflora to periodontally pathogenic bacteria, i.e. increased proportions of Gram-negative anaerobic bacteria and black-pigmented *Bacteroides* (Lang et al. 1983). However, even technically perfect RMs exhibit marginal gaps of about 10–50 μm (Vale & Caffesse 1979, Ehrnford & Dérand 1984). A bacterial cell has a diameter of about 1 μm. Thus, even technically perfect marginal gaps always facilitate bacterial colonization and increase the risk for periodontal breakdown. Another tooth-specific factor may be endodontic infection indicated by a periapical lesion. In periodontitis patients,

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teeth with periapical lesions exhibited more bone loss over a period of at least 3 years than teeth without periapical lesions (Jansson et al. 1995). However, even without periapical signs of infection (i.e. periapical lesion), periodontal conditions in root canal filled (RCF) teeth may be worse than in vital teeth. (1) Infection and inflammation of the pulp may have induced breakdown of adjacent periodontal tissues via lateral canals before endodontic treatment (Hirsch & Clarke 1993, Meng 1999). (2) After the removal of the pulp and its replacement by a filling material, diffusion of extracellular fluids from the pulp through dentine canals to the root cementum is lacking. This may deteriorate periodontal stability of teeth even after proper root canal treatment. (3) Constituents of RCF materials may diffuse through the dentinal tubules and induce periodontal inflammation (Sjögren et al. 1998). (4) After endodontic treatment, bacteria and/or bacterial antigens (i.e. lipopolysaccharids) may remain in the dentinal tubules and maintain periodontal inflammation (Ehnevid et al. 1993). (5) Although not detectable by radiographs, a periapical lesion may still remain invisible due to projection at the buccal or the oral aspect of a tooth. In periodontitis patients, teeth with endodontic treatment had more bone loss as compared with untreated teeth (Timmerman & van der Weijden 2006). However, root canal treatment in most cases is associated with interproximal restorations. RMs by themselves are local risk factors for periodontal destruction and, thus, may be the reason for increased bone loss in teeth with root canal treatment (Lang et al. 1983, Wang et al. 1993). Hence, it is not clear whether RCF themselves or the RMs that come with them are risk factors for periodontal destruction.

Thus, the purpose of this study was to test the hypothesis that teeth adequately endodontically treated develop more periodontal bone loss than their contralateral counterpart without RCF in periodontitis patients under consideration of interproximal RMs.

Material and Methods

Patients

Starting with the year 2005, the charts of periodontitis patients that had received comprehensive periodontal treatment at the Department of Periodontology, Center of Dental, Oral, and Maxillofacial Medicine, Johann Wolfgang Goethe-University Frankfurt am Main, were screened antichronologically for complete sets of intra-oral periapical radiographs, which had been obtained before periodontal therapy. Medical history at the start of periodontal treatment at the Department of Periodontology encloses a questionnaire on current and past smoking status including the number of cigarettes smoked per day and the period of smoking in years. According to this information, patients were classified according to the smoking status. Patients who had reported to smoke were classified smokers, patients who had quit smoking as former smokers and patients who had never smoked as never smokers. For each patient, the pack years were calculated.

Inclusion criteria:

- complete set of intra-oral periapical radiographs,
- at least one tooth with a proper RCF (RCF extends apically between the radiographic apex or 2 mm coronal of the radiographic apex) that was at least 2 years old at the time the radiograph was obtained and
- one contra-lateral tooth without RCF and without radiographic (periapical radiolucency) or clinical evidence (negative sensitivity test) for endodontic pathology. Two teeth were looked upon as contra-lateral if they were located in the same jaw (maxilla or mandible) on contralateral sides (right and left side), and belonged to the same type: (1) anteriors (incisors and canines), (2) pre-molars and (3) molars.

Exclusion criteria:

- RCF tooth with

(1) periapical radiolucency (gap between the apex and periapical bone >1 mm),
(2) overfilled root canal (RCF reaching apically beyond the apex) and
(3) underfilled root canal (gap >2 mm between RCF and the radiographic apex).

A total of 66 pairs of radiographs from 53 periodontitis patients were included in the analysis. The patients ranged from 34 to 73 years of age (53.8 ± 9.8 years). Twenty-six patients were females (49%). Twelve patients were current smokers, of whom five were females.

Table 1. Number and distribution of examined pairs of teeth according to jaw and tooth type

Type of tooth	Maxillary	Mandibular	Total
Anterior	13	6	19
Premolar	10	15	25
Molar	6	16	22
Total	29	37	66

Two patients contributed three pairs of contra-lateral teeth (test/control), nine patients contributed two pairs of teeth and 42 patients contributed one pair each. The distribution of defects according to tooth type (anterior/pre-molar/molar) and jaw (maxilla/mandible) is given in Table 1. At 50 sites (38%), the coronal anatomical landmark for measurements was CEJ, and at 70 (53%) teeth, more profound bone loss was located mesially (Tables 2 and 3). Fifty-eight (44%) measurements were performed in the maxilla and 38 (29%) at the anterior teeth (Tables 2 and 3).

Radiographic examination

Before active periodontal treatment (subgingival debridement and periodontal surgery if required), complete sets of periapical radiographs of each patient (Insight, Eastman Kodak, Rochester, NY, USA) were obtained in XCP format using standardized film holders (XCP, Kentzler & Kaschner Dental, Ellwangen/Jagst, Germany). Dental films of intra-oral size 0 (maxillary canines and mandibular anteriors) and two (all other regions) were exposed to an X-ray source with 7 mA and 60 kVp (Heliodent DS, Sirona, Bensheim, Germany) and developed under standardized conditions (XR24pro, Dürr Dental GmbH, Bietigheim-Bissingen, Germany).

Definition of radiographic landmarks

The radiographic landmarks were defined as follows: if the cemento-enamel junction (CEJ) was destroyed by restorative treatment, the RM was taken as the coronal landmark (Fig. 1). Bony defect (BD) was defined as the most coronal point where the periodontal ligament space showed a continuous width (Fig. 1). If no periodontal ligament space could be identified, the

Table 2. Distances cemento-enamel junction (CEJ)/restoration margin (RM) to alveolar crest (AC) for the test and the control, restoration margin (yes/no), site (mesial/distal) and jaw (maxilla/mandible)

	CEJ/RM to AC (mm)		p
Split mouth	Root canal filling $N = 66$ 3.30 ± 1.87	No root canal filling $N = 66$ 3.34 ± 2.16	0.892
Parallel groups	CEJ $N = 50$ 3.76 ± 2.31	RM $N = 82$ 3.05 ± 1.77	0.064
	Mesial $N = 70$ 3.40 ± 2.16	Distal $N = 62$ 3.23 ± 1.83	0.632
	Maxilla $N = 58$ 3.42 ± 2.18	Mandible $N = 74$ 3.24 ± 1.87	0.614
	Anterior $N = 38$ 4.12 ± 2.22	Posterior $N = 94$ 3.00 ± 1.84	0.008

Table 3. Distances cemento-enamel junction (CEJ)/restoration margin (RM) to most apical extension of bony defect (BD) for test and control, restoration margin (yes/no), site (mesial/distal) and jaw (maxilla/mandible)

	CEJ/RM to BD (mm)		p
Split mouth	Root canal filling $N = 66$ 5.57 ± 2.70	No root canal filling $N = 66$ 5.14 ± 2.82	0.159
Parallel groups	CEJ $N = 50$ 5.67 ± 2.98	RM $N = 82$ 5.16 ± 2.61	0.322
	Mesial $N = 70$ 5.62 ± 2.98	Distal $N = 62$ 5.06 ± 2.24	0.238
	Maxilla $N = 58$ 5.55 ± 3.04	Mandible $N = 74$ 5.20 ± 2.52	0.486
	Anterior $N = 38$ 6.17 ± 3.01	Posterior $N = 94$ 5.03 ± 2.59	0.044

point where the projection of the alveolar crest (AC) crossed the root surface was used as the landmark (Benn 1992). If both structures could be identified at one defect, the point defined by the periodontal ligament was used as BD and the crossing of the silhouette of the AC with the root surface was defined as AC. If several bony contours could be identified, the most apical one that crossed the root was defined as the BD and the most coronal one as AC (Eickholz et al. 1996). For all defects, the distances CEJ/RM to AC and CEJ/RM to BD were measured using the measurement tool (Figs 1 and 2). These measurements were repeated after 14 days for each 10th radiograph after initial measuring, to evaluate the radiographic measurement error.

Examiner calibration and radiographic evaluation

Using 20 radiographs of infrabony defects unrelated to this study, the examiner (D. A.-F.) was calibrated before evaluating the study radiographs. The principal investigator (P. E.) instructed and trained the examiner in finding the anatomical landmarks and measuring the respective distances. Replicate measurements (CEJ/RM to AC and CEJ/RM to BD) of the examiner were then performed with a 14-day interval and compared. An agreement within 0.5 mm in 90% of all measurements should be achieved. Until this agreement was not achieved, all discrepancies were discussed and all measurements were repeated until the desired agreement was achieved.

Patients' charts were screened until 50 qualifying patients were found. At least 30% of all test (RCF tooth) and control (contra-lateral without RCF) teeth should exhibit a restoration at one interproximal site. To assess the reproducibility of the measurements of distances CEJ/RM to AC and CEJ/RM to BD, 20 sites in 20 radiographs were measured in duplicate 14 days apart. After one cycle of retraining, the difference between both measurements was below 0.5 mm in 100% for CEJ/RM to AC assessments and 95% for CEJ/RM to BD assessments. Standard deviations of single measurements were 0.12 mm (CEJ/RM to AC) and 0.09 mm (CEJ/RM to BD).

All 132 radiographs (66 in pairs, one with and one contra-lateral without RCF) were numbered at a random sequence by the principal investigator (P. E.) from 1 to 132 and subsequently measured by the examiner (D. A.-F.). Measurements were ensued by choosing every eighth radiograph non-chronologically, to ensure the masked randomization. Each radiograph was identified by the two beginning letters of the last and first patients' name, the standard FDI tooth code and the coronal radiographic landmark (CEJ for the cemento-enamel junction, if destroyed by restorative treatment, RM the restoration margin): e.g. SaHa43CEJ: SaHa, the first two letters of last and the first patient's name, 43 (mandibular right canine), CEJ as the coronal radiographic landmark.

All radiographs were digitized using a computer program (SIDEXIS, Sirona) and a flatbed scanner (Microtek ScanMaker 8700, Microtek, Hsinchu, Taiwan) with a 600 dpi resolution and 8 bit grey values. The radiographs were mounted on a black frame (small for size 0 radiographs; large for size 2 radiographs) for measurement. The image files were stored as TIFF files and analysed by the examiner (D. A.-F.) using the computer program SIDEXIS and a 19′ flat screen (Totoku CCL 192 plus, Totoku Electric, Ueda, Japan) in a particular room under exclusion of natural or artificial light, except for the light of the screen. Measurements were made to the nearest 0.01 mm.

For evaluation, the analysing tool of the program SIDEXIS was used. The

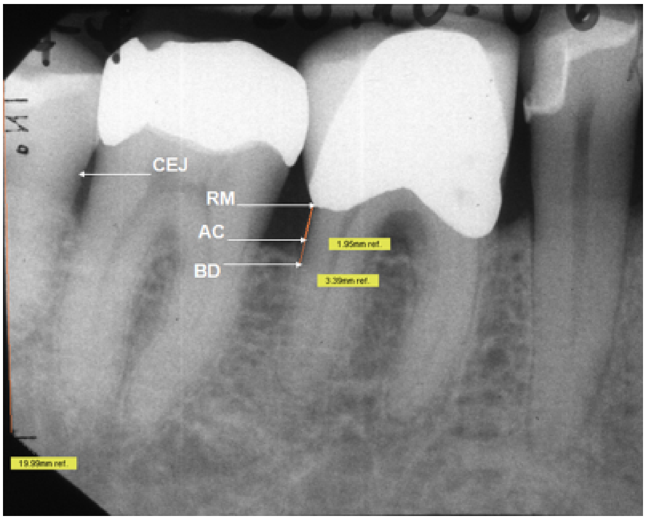

Fig. 1. Definition of radiographic landmarks: mandibular right first molar without root canal filling. Measurements of radiographs: the distances RM to AC and RM to BD were measured at the distal site. CEJ, cemento-enamel junction; BD, bony defect; RM, restoration margin; AC, alveolar crest.

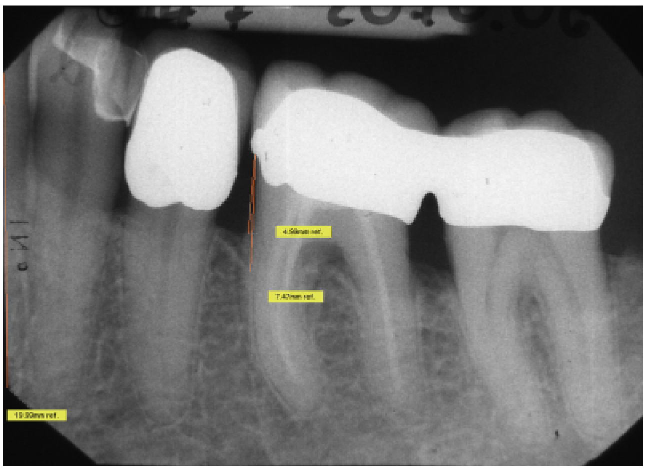

Fig. 2. Measurements of radiographs: mandibular left first molar with root canal filling (contra-lateral of Fig. 1): the distances restoration margin (RM) to alveolar crest and RM to bony defect were measured at the mesial site.

image files were opened and magnified using the function ''zoom'' once (6-fold magnification). Then the distances CEJ/RM to AC and CEJ/RM to BD were measured at the site of most pronounced bone loss. Further, it was assessed whether a post could be recognized on the radiograph within the root canal.

Statistical analysis

To show a clinically relevant mean difference of 0.5 mm for the radiographic distances CEJ/RM to AC and CEJ/RM to BD between teeth with and without RCF for a standard deviation of differences of 0.82 mm (Wolf et al. 2001) with a type 1 error $\alpha < 0.05$ and a test power of 80%, a sample of 61 radiographs was required. The main outcome variable was the radiographic measurement of the distance CEJ/RM to BD. The radiographic measurement of the distance CEJ/RM to AC was the secondary outcome variable.

The sample was described by age at the time point of radiographic examination (mean $\pm$ standard deviation, range), sex and the number of defects that were contributed by the different patients. The distribution of defects according to jaw (maxilla/mandible) and tooth type [anterior (incisors and canines), pre-molars and molars] was assessed.

For each tooth, only the site (mesial or distal) with the most pronounced bone loss was included in the analysis. The distances CEJ/RM to BD and CEJ/RM to AC were compared between teeth with (test) and without (control) RCF by a paired *t*-test and between sites with and without RM, between jaws (maxilla/mandible), between sites (mesial/distal) and tooth type (anterior/posterior) by an unpaired *t*-test.

Some patients contributed more than one pair of defects to the study. Thus, with respect to the patient as the statistical unit, multilevel regression analyses were performed (Goldstein 1995, Goldstein et al. 2002). For this analysis, the basic level ''tooth'' was nested in the upper level ''patient'' and patient effects on the outcome were assumed to be random. The following influencing factors were entered in the analysis to explain the dependent variables distances CEJ/RM to BD and CEJ/RM to AC: RCF (yes/no), RM (yes/no), jaw (maxilla/mandible), tooth type (anterior/posterior), post (yes/no), age, current smoking and pack years.

Statistical analysis was performed using a PC program (Systat™ for Windows Version 10, Systat Inc., Evanston, IL, USA).

Results

Whereas only 31 of the sites assessed in teeth without RCF (47%) showed interproximal RM, 51 sites measured at teeth with RCF (77%) exhibited RM ($p < 0.001$).

The study showed statistically significant differences for the distance CEJ/RM to AC (Table 2) and CEJ/RM to BD (Table 3) only for tooth type: radiographic bone loss in anterior teeth was more pronounced than in posteriors. The multilevel regression models confirmed this observation: despite tooth type of the considered factors, only pack years showed a statistically significant difference regarding CEJ/RM to BD (Table 4). Pack years correlated statistically significantly with bone loss. The distance CEJ/RM to AC did not show any influence (Table 5).

Discussion

The procedure to evaluate conventional radiographs used in this study has been validated recently. The differences between the radiographic measurements and the gold standard of intra-surgical measurements of infrabony defects were

Table 4. Multilevel regression analysis (dependent variable: distance CEJ/RM to BD, 53 patients/132 teeth)

	Estimate	Standard error	*Z* value	*p*
Root canal filling	0.378	0.375	1.008	0.314
Restoration margin	0.306	0.470	0.650	0.516
Mesial	0.279	0.380	0.735	0.463
Maxilla	0.048	0.494	0.096	0.923
Anterior	**1.218**	**0.589**	**2.069**	**0.039**
Post	− 0.085	0.625	− 0.135	0.892
Age	− 0.061	0.032	− 1.906	0.057
Female sex	0.295	0.615	0.480	0.631
Smoker	0.167	0.797	0.210	0.834
Pack years	**0.033**	**0.017**	**2.000**	**0.045**

Statistically significant ($p < 0.05$) factors in bold.

Table 5. Multilevel regression analysis (dependent variable: distance CEJ/RM to AC, 53 patients/132 teeth)

	Estimate	Standard error	*Z* value	*p*
Root canal filling	0.013	0.305	0.042	0.967
Restoration margin	− 0.197	0.370	− 0.531	0.595
Mesial	− 0.242	0.304	− 0.796	0.426
Maxilla	− 0.058	0.376	− 0.155	0.877
Anterior	**1.100**	**0.438**	**2.509**	**0.012**
Post	− 0.013	0.499	− 0.026	0.979
Age	− 0.015	0.023	− 0.651	0.515
Female sex	0.119	0.435	0.274	0.784
Smoker	0.492	0.567	0.869	0.385
Pack years	0.014	0.012	1.177	0.239

Statistically significant ($p < 0.05$) factors in bold.

small (CEJ/RM–BD: 0.97–1.06 mm) (Tihanyi et al., in press) and were less pronounced than those reported by other working groups: CEJ/RM–BD: around 2.0 mm (Li et al. 2007) and CEJ/RM–BD: 1.5–1.7 mm (Jorgensen et al. 2007). Digital processing and filtering of radiographic images was not used in this study. Previous work evaluating the effect of digital ''enhancement'' on the accuracy of linear measurements of interproximal bone failed to show improvements in accuracy (Eickholz et al. 1999, Wolf et al. 2001, Hörr et al. 2005, Jorgensen et al. 2007). Thus, the method to evaluate radiographs may be judged as appropriately precise.

A comparison of contra-laterals was chosen due to the fact that the dentition is symmetrical and even periodontal breakdown exhibits symmetrical patterns (Papapanou et al. 1988). Thus, for the comparison of periodontal bone loss at teeth with and without RCF, a split-mouth design with contra-lateral teeth is most effective (Timmerman & van der Weijden 2006). Further, if an RCF is inducing periodontal bone loss around a tooth, it may do so in all directions. Only the interproximal aspects may be assessed by periapical radiographs. To observe the most pronounced effect, the site (mesial or distal) with the most pronounced bone loss (i.e. distance CEJ/RM to AC/BD) was used for analysis in contra-lateral teeth.

Why did Timmerman & van der Weijden (2006) find more bone loss in endodontically treated teeth and this study did not? Whereas Timmermann and Van der Weijden also included endodontically treated teeth with endodontic lesions (i.e. periapical radiolucency at 14% of teeth), the present study made an attempt to exclude teeth with obvious endodontic problems. RCF teeth with periapical radiolucency (gap between apex and periapical bone >1 mm), overfilled root canal (RCF reaching apically beyond the apex) or underfilled root canal (gap >2 mm between RCF and radiographic apex) were excluded. It is already known that periodontitis patients exhibit, in teeth with periapical lesions, more bone loss over a period of at least 3 years than teeth without periapical lesions (Jansson et al. 1995). The inclusion of root-canal-treated teeth with periapical lesions by Timmermann & Van der Weijden (2006) may explain more bone loss at endodontically treated teeth in general. Whereas the failure to detect a statistically significant difference in bone loss between teeth with and without RCF in this study may be due to the exclusion of teeth with periapical lesions, it has been shown previously that regenerative treatment of intra-bony defects in teeth with or without RCF made no difference regarding attachment gain. However, only RCF without obvious endodontic problems were included in this study. At least proper RCF do not seem to affect healing after regenerative periodontal surgery (Cortellini & Tonetti 2001).

Katsamakis et al. (2009) compared the radiographic bone loss at teeth with endodontic post and at contra-laterals without endodontic posts. Only a minority (14%) of these contra-laterals were endodontically treated. However, the study failed to find a significant difference in bone loss between teeth with and without endodontic posts (Katsamakis et al. 2009). This observation contrasts with the results of Timmerman & van der Weijden (2006). Katsamakis et al. (2009) failed to find a statistically significant difference between teeth with posts and teeth without posts, of which only 14% were endodontically treated. Thus, they compared, to some extent, again endodontically treated teeth with posts and teeth without RCF (86%) and failed to find a difference regarding interproximal bone loss (Katsamakis et al. 2009). Thus, the topic of whether endodontically treated teeth have a higher risk for interproximal bone loss at least is discussed controversially. The only difference that was observed was the frequency of angular defects at mesial sites. At the mesial site of teeth with endodontic posts, more angular defects were found than at mesial aspects of the contra-laterals without posts. This difference could not be found at the distal aspect of teeth (Katsamakis et al. 2009). Why do posts cause angular BDs more often at mesial than at distal sites? The observation that infrabony defects are found more often at mesial sites than at distal sites has been made before independently from endodontic treatment or posts in an analysis of full-mouth sets of intra-oral radiographs in a periodontitis patient sample (Kim et al. 2006). Thus, one is more likely to find angular defects at the mesial site of teeth any way.

If RMs by themselves are local risk factors for periodontal destruction (Lang et al. 1983, Wang et al. 1993), why did the present study fail to observe more bone loss at sites with interproximal

RMs? The majority of teeth with RCF may exhibit a restoration extending into the inter-dental space or a crown. The present study confirms this assumption with 31 scored sites with interproximal RM at teeth without RCF (47%) and 51 scored sites with RM at teeth with RCF (77%). These RM interfere with the objective of this study in two ways: (1) the RM may be the reason for increased bone loss in the case group. Under experimental conditions, the marginal gap of a restoration reaches technical perfection at about 10–50 μm (Vale & Caffesse 1979, Ehrnford & Dérand 1984). A bacterial cell has a diameter of about 1 μm. Thus, even technically perfect marginal gaps always facilitate bacterial colonization and increase the risk for periodontal breakdown. (2) By destroying the natural CEJ, the RM is likely to shift apically the reference for bone loss measurements. If bone loss is measured as the distance from the RM to BD, the actual amount of bone loss may be underestimated. The dilemma of these two conflicting aspects may prevent the detection of RM as a risk factor for periodontal bone loss.

The only difference regarding the distances CEJ/RM to AC and CEJ/RM to BD was found according to tooth type. Anterior teeth exhibited more bone loss than posteriors. This observation has been made in a representative Swedish sample before: teeth in the incisor regions consistently showed the highest frequency of advanced alveolar bone loss and the lowest frequency of normal tissue support, while the corresponding figures for teeth in the molar regions were found to be the opposite. However, molars were the most frequently missing teeth (Papapanou et al. 1988). It is a common observation that molars exhibit a higher rate of tooth loss than anterior teeth (Schätzle et al. 2004, Faggion et al. 2007, Pretzl et al. 2008). Tooth loss is likely to affect the extent of bone loss in posteriors. If those molars with most severe bone loss are extracted, the mean bone loss in posteriors is reduced.

Current smoking status at the time the radiographs were obtained did not affect bone loss. However, pack years positively correlated with the distance CEJ/RM to BD. For smoking, there exists a dose–effect relation (Tomar & Asma 2000). Thus, in a cross-sectional study, it is plausible that the dose-related smoking variable pack years shows a relation to radiographic bone loss, whereas current smoking status does not.

Within the limits of the present study the following conclusion may be drawn:
Teeth with endodontic treatment (RCF) failed to exhibit more bone loss than endodontically untreated teeth.

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Clinical Relevance

Scientific rationale for the study: In periodontitis patients, teeth with endodontic treatment have been found to exhibit more bone loss than endodontically untreated teeth. However, root canal treatment in most cases is associated with interproximal RMs, which by themselves are local risk factors for periodontal destruction. Thus, the purpose of this study was to evaluate interproximal bone loss at contra-lateral teeth with and without RCF in periodontitis patients under consideration of interproximal RMs.

Principal findings: Teeth with endodontic treatment failed to exhibit more bone loss than endodontically untreated teeth.

Practical implication: Within the same patient, adequately endodontically treated teeth have a similar prognosis regarding periodontal bone loss as endodontically untreated contra-lateral teeth.