Radiographic Bone Fill Following Non-Surgical Therapy – A Report of Three Cases

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Purpose: Non-surgical therapy, including scaling, root planing, and personal plaque control continues to be a powerful effective treatment modality for treating chronic periodontal diseases. Reports in the literature have suggested that adjunctive procedures such as systemic antibiotics and topical antiseptics may enhance the clinical outcomes of non-surgical treatment.

Material and Methods: Three retrospective case reports spanning an evaluation period of 9–36 months are presented. The patients were treated in a private periodontal practice and had advanced periodontal disease. A significant positive clinical and radiographic response was achieved with non-surgical and adjunctive therapy.

Results: The teeth that were treated initially had deep angular bony defects with probing depths ranging 5–8 mm. Following non-surgical and adjunctive therapy, probing depths were considerably reduced and ranged 3–5 mm. As well, a significant degree of radiographic osseous fill of the angular defects was observed.

Conclusions: In light of the dramatic healing responses observed in these cases, the healing potential of deep periodontal defects with non-surgical and adjunctive therapy requires further investigation. Once the critical elements contributing to the positive responses noted can be identified, then perhaps a more predictable outcome may be achieved in future cases.

Key words: non-surgical, adjunctive therapy, clinical, radiographic, response

Oral Health Prev Dent 2003; 1: 119–128. Submitted for publication: 24.10.02; accepted for publication: 09.04.03.

Scaling and root planing procedures combined with personal plaque control have been shown to be an effective therapy modality in the control of chronic periodontitis. The benefits of root planing procedures include decreased probing depths, a reduction of gingival inflammation, a gain of clinical attachment, a reduction of pathogenic bacteria and a reduction in disease progression. (The American Academy of Periodontology position paper, 2001; Morrison et al, 1980; Garret, 1983; Badersten et al, 1981,1984; Hughes et al, 1978; Magnusson et al, 1984; Philstrom et al, 1983)

There has been a great deal of information published on the positive clinical responses to scaling and root planing. Cobb, in a comprehensive review of the literature, examined the reduction in probing depths and changes in attachment levels to mechanical instrumentation and reported the following changes: the mean reduction in probing depths with an initial depth of 1–3 mm was calculated to be 0.03 mm with a mean net loss in attachment level of –0.34 mm. Pockets measuring 4–6 mm experienced a mean reduction probing depth of approximately 1.29 mm with a net gain in clinical attachment levels of 0.55 mm. Periodontal pockets

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which had an initial probing depth ≥ 7 mm experienced the greatest reduction of mean probing depth of 2.16 mm and a gain in attachment level of 1.19 mm. (Cobb, 2002).

The reports available regarding the radiographic osseous responses to root planing appear however to have mixed results.

Jeffcoat and co-workers studied the adjunctive effect of naproxen on alveolar crestal height in adults with rapidly progressive periodontitis. The experimental group (scaling and naproxen) responded with 0.27 mm gain while the control group that received scaling only experienced a mean bone loss of 0.14 mm. (Jeffcoat et al, 1991)

Schmidt and co-workers utilized digital subtraction radiography (DSR) to determine the crestal bone response to scaling and root planing procedures. Bone gain was noted in 7 sites while twice as many sites (14) exhibited bone loss (Schmidt et al, 1988). Okano and co-workers using the DSR technique reported a continued increase in crestal bone density, 1–6 months following scaling and root planing (Okano et al, 1990). Machtei et al looked at the radiographic and clinical responses to periodontal therapy in a group of 108 patients over a period of 15 months. They found a mean overall probing depth reduction and attachment level gain of 0.5 mm and 0.44 mm respectively. The mean overall change in alveolar crestal height was – 0.07 mm, of which 11.8% of all sites exhibited attachment level gain (Machtei et al, 1998).

The purpose of this article is to describe the treatment and outcome of three retrospective cases, which demonstrated significant positive clinical and radiographic responses with scaling, root planing, and adjunctive procedures in a private periodontal practice. The root planing procedures were done by the same author (B.G.). All standard radiographs were taken using a long cone parallel technique trying as much as possible to remain consistent with angulations and exposures and all evaluations were performed by the same author (A.F.).

MATERIALS AND METHODS

CASE 1: Tooth 36

Patient Information

The first case report describes the non-surgical periodontal treatment of a 50-year-old female. Of significance in her medical history was a smoking habit of ten cigarettes per day. She was taking calcium supplements as well as estrogen for hormone replacement therapy. She presented with an initial complaint of receding gums, sensitive, and loose teeth. She related having an episode of pain in the mandibular left posterior area a number of months previously. At that time, she was prescribed a course of antibiotics, which included metronidazole and penicillin. Her previous dental care was not consistent and she had not had a professional cleaning for six years. She reported that with previous dental appointments requiring local anesthesia she had problems with headaches afterwards and preferred to avoid local anesthesia administration if it were possible.

Periodontal Diagnosis

A comprehensive periodontal examination revealed generalized moderate to advanced chronic periodontal disease. From a total of 66 probed sites in the maxilla, nine sites probed 4–5 mm and one site probed 6 mm. In the mandible from 84 probed sites, there were nine sites probing 4–5 mm and five sites probing 6 mm. The full mouth bleeding score was 2.3% The initial probing depths of significance on tooth 36 were 6 mm on the mesial buccal (M Bu) with exudate and mesial lingual (M Li). The probing depths were 5 mm on the distal buccal (D Bu), and 3 mm on the distal lingual (D Li) (Table 1). A class 1 Miller classification mobility was noted. Due to the advanced attachment loss, the tooth was given a guarded prognosis.

Treatment Rendered

Antibiotic therapy began the same day that tooth 36 was root planed. A course of doxycycline was prescribed for fourteen days; 100 mg capsules, two taken immediately, then one per day until finished. The tooth was instrumented without local anesthesia using an ultrasonic scaler, periodontal files, and curettes until the surfaces felt smooth to the tactile sensation with a periodontal probe. The pockets were then irrigated with 10 cc of an equal mixture of 1% povidone-iodine* and 3% hydrogen peroxide. The patient tolerated the procedures without any adverse effects.

* Betadine Mouthwash Gargle, Purdue Pharma, Pickering, Ontario, Canada.

Table 1 Probing Depth Changes

Case	Tooth No.	Location	I.P.D. mm	P.T.P.D. mm	Change mm	Time Months P.T.P.D.
1	36	M Bu	6	3	3	9
		M Li	6	3	3	
		D Bu	5	3	2	
		D Li	3	3	0	
2	33	M Bu	8	5	3	30
		M Li	7	3	4	
		Mid Li	7	2	5	
		D Li	7	3	4	
2	36	M Bu	8	4	4	36
		M Li	7	3	4	
3	46	M Bu	8	5	3	14
		M Li	5	3	2	

I.P.D. Initial Probing Depth
P.T.P.D. Post-Treatment Probing Depth

Home Care Instructions

Disclosing solution was used at the initial therapy sessions for patient education. Plaque control through brushing using a modified Bass technique, and the use of interproximal brushes were demonstrated. Listerine** rinses 15 cc were prescribed for use twice daily. Initially, the patient rarely flossed, but with encouragement and review, began flossing daily and soon showed excellent plaque control.

Clinical Procedures and Follow-up Visits

The patient's periodontal status was re-evaluated two months after completion of initial therapy procedures. The probing depths in the maxilla remained generally the same. Tooth 16 developed an endodontic problem and due to a hopeless prognosis required extraction. The mandibular periodontal status demonstrated greater improvement. From 84 sites probed, 10 sites remained with probing depths of 4–5 mm. There were no sites probing greater than 5 mm. The full mouth bleeding score remained about the same at 2.7%.

The M Bu probing depth of tooth 36 reduced from 6 mm to 5 mm, while the D Bu probing depth reduced from 5 mm to 3 mm. The M Li improved from 6 mm to a probing depth of 3 mm. The patient was compliant in maintaining her periodontal health with excellent plaque control and attended the office for maintenance therapy at 3–4 month intervals. At a further evaluation nine months after completion of initial therapy, the M Bu probing depth had reduced an additional 2 mm and probed 3 mm. The remaining areas around the tooth remained stable with probing depths in the 2–3 mm range. There was no mobility, bleeding, or suppuration evident (Table 1).

Radiographic Findings

The pre-treatment periapical film of tooth 36 (Fig 1) revealed angular bony defects on the mesial and distal surfaces extending to the apices of the roots. There was no periapical pathology present. The periapical film taken at the re-evaluation appointment nine months later revealed significant radiographic fill of both the mesial and distal vertical defects. A ceramic crown had been placed on the tooth without any local anesthesia by her referring dentist (Fig 2).

** Listerine Pfizer, Toronto, Canada

Fig 1 Case 1 (tooth 36) Initial.

Fig 2 Case 1 (tooth 36) Nine Months.

CASE 2: Teeth 33 and 36

Patient Information

The next case report involved the treatment of a 46-year-old male. Of note in his medical history was an adverse reaction to a chlorhexidine rinse that caused intra-oral blisters. He complained of receding, painful gums, sensitive, loose and shifting teeth. His dental care was infrequent, with only two professional cleanings in the last five years.

Periodontal Diagnosis

A diagnosis of generalized moderate with localized advanced chronic periodontitis was established. From 60 probing sites in the maxilla there were six probing depths in the 4–5 mm range. In the mandible, from 78 sites probed, seven were in the 4–5 mm range and ten were in the in the 6–8 mm range. The full mouth bleeding score was 17%. Suppuration and bleeding on probing was evident on the M Li of tooth 33. Bleeding on probing was noted on the M Bu of tooth 36.

Specific to this case presentation, tooth 33 had initial probing depths of 8 mm on the M Bu, and 7 mm on the M Li, mid lingual (Mid Li), and D Li surfaces (Table 1). There were a minimal zone of keratinized tissue on the facial surface. There was no mobility patterns noted. Tooth 36 had an initial probing depth of 8 mm on the M Bu and 7 mm on the M Li (Table 1). There was no mobility evident. Due to the advanced attachment loss, teeth 33 and 36 were given a guarded prognosis.

Treatment Rendered

A regimen of doxycycline as prescribed in Case 1 was administered in conjunction with the root planing procedures. The instrumentation techniques were similar. However, there was no irrigation used. The patient had been on the antibiotic regimen for 4 days at the time tooth 36 was root planed. Root planing was accomplished with local anesthesia utilizing Ultracaine D-S Forte***.

Home Care Instructions

Disclosing solution was used for patient education purposes. A modified Bass brushing technique was demonstrated. Flossing using a floss holder was also recommended due to the patient's manual dexterity difficulties. For adjunctive oral hygiene aids, an interdental brush was introduced.

Clinical Findings and Follow-up Procedures

Two months after completion of initial therapy procedures, a post-treatment evaluation of the patient's periodontal status was done. The overall clinical response was good; with many areas, demonstrating reduced probing depths. The maxilla had four 5 mm pockets remaining. Probing depths in the mandible also improved with two 5 mm pockets remaining and one 7 mm pocket (with suppuration) present on the M Bu of 36. The full mouth bleeding score was reduced to 2.9%. A significant improvement of the periodontal status of tooth 33 had occurred, with Li probing depths reduced to 2–3 mm. A residual probing depth of 5 mm remained on the M Bu surface. No bleeding on probing was evident. The healing response of tooth 36 was not significant and a post-treatment 7 mm probing depth remained on the M Bu surface with suppuration. A residual 5 mm

*** HANSArmed Ltd. Mississauga, Ontario, Canada.

Fig 3 Case 2 (tooth 33) Initial.

Fig 5 Case 2 (tooth 33) 36 months.

Fig 4 Case 2 (tooth 36) Initial.

Fig 6 Case 2 (tooth 36) 36 months.

probing depth on the m Li surface was noted as well. Since his plaque control was not consistent he was not considered a good surgical candidate. Additional root planing was rendered for tooth 36 with local anesthesia utilizing Ultracaine D-S Forte during a full mouth debridement appointment. Oral hygiene was re-emphasized as well, especially for the mandibular arch. Due to the high level of disease activity and lack of positive response to initial therapy the pockets were irrigated with 10 cc of an equal mixture of 1% povidone-iodine and 3% hydrogen peroxide. A Listerine rinse 15 cc b.i.d. was also prescribed to help control pathogenic bacteria. A re-evaluation four weeks later revealed probing depths on tooth 36 reduced to 4 mm on the M Bu and 3 mm on the M Li (Table 1). Bleeding was noted on the M Li when probing. Three-month maintenance intervals were initiated. There was no further irrigation provided over the follow-up evaluation period of three years.

Radiographic Findings

The initial periapical film of tooth 33 (Fig 3) revealed 50% horizontal bone loss on the mesial surface with a vertical bony defect component. The initial radiographic vertical bony defect mesial 36 (Fig 4) extended down to the apical third of the root. The post treatment radiographs taken 36 months later of teeth 33 (Fig 5) and 36 (Fig 6) revealed significant radiographic bone fill on the mesial surfaces of both teeth. There was incipient caries developing on the mesial surface of tooth 36, which was being monitored by the referring dentist.

CASE 3: Tooth 46

Patient Information

The final case describes the treatment of a 56-year-old male. There were no significant underlying medical concerns. He had quit smoking 17 years previously. The patient was not taking any medications. He did not have any discomfort other than some tooth sensitivity after professional cleanings. He was aware of receding gums. His referring dentist provided the patient maintenance therapy every three to four months.

Periodontal Diagnosis

A diagnosis of generalized early, with localized advanced periodontitis was established. In the maxilla, from a total of 72 probing sites, nine sites were in the 4–5 mm range and two had 6 mm probing depths. In the mandible from a total of 72 sites, nine were in the 4–5 mm range and four were in the 7–9 mm range. As a full mouth score 15.5% of the sites probed bled on probing. The initial probing depths on the M Bu and the M Li of tooth 46 were 8 mm and 5 mm respectively (Table 1). There was no mobility or bleeding noted in those areas. The prognosis of tooth 46 was guarded.

Treatment Rendered

The therapy rendered consisted of scaling and root planing utilizing the local anesthesic Ultracaine D-S Forte. The instrumentation techniques used were similar as in the other two cases. The patient had been on a course of doxycycline (as prescribed in the two previous cases) for ten days prior to the root planing procedure. Each of the pockets were irrigated with an equal mixture of 10 cc 1% povidone-iodine and 3% hydrogen peroxide. A twice-daily application of 0,12% chlorhexidine gel was prescribed as an adjunct for plaque control. Toothpaste for sensitive teeth was used sporadically at first, then on a daily basis.

Home care Instructions

Disclosing solution was used for patient education during the initial therapy sessions and maintenance visits. With time, the patient began flossing on a daily basis and used a powered toothbrush for daily plaque control.

Clinical Findings and Follow-up Procedures

A re-evaluation was done two months after completion of initial procedures. The overall healing response was good. In the maxilla there were five sites probing 4–5 mm. There was a 6 mm probing depth noted on the D Li of 27. In the mandible there was one 5 mm pocket remaining (M Bu 46). Bleeding on probing was reduced to 12.5%. The use of the chlorhexidine gel dropped off over time, and it was recommended that he dip his interdental brush in Listerine and apply it to the pocket areas as well as rinsing with it twice daily. During the 3–4 month interval maintenance visits, irrigation with the 10 cc 1% povidone-iodine and 3% hydrogen peroxide solution continued in the pocket areas. When a re-evaluation was done 14 months later, the probing depths on tooth 46 were 5 mm on the M Bu and 3 mm on the M Li surface (Table 1). Bleeding was noted on the M Li surface.

Radiographic findings

The initial periapical film of tooth 46 revealed a significant vertical defect located on the mesial surface, which extended to the apical third of the root (Fig 7). The periapical film taken 14 months after treatment revealed substantial radiographic fill of the vertical defect (Fig 8).

DISCUSSION

The case studies presented describe the clinical and radiographic responses of three patients who demonstrated a significant reduction of disease activity, probing depths, and radiographic osseous fill of periodontal defects that were treated with scaling, root planing procedures, and adjunctive therapy. All the patients presented with advanced chronic periodontitis and had initial probing depths ranging 5–8 mm.

Instrumentation in pockets of this magnitude to remove plaque and calculus is very difficult. Scaling and root planing effectiveness decreases with increased probing depths (Cafesse et al, 1986; Buchanan et al, 1987; Brayer et al, 1989). Waerhaug reported after analyzing extracted teeth that had been root planed, that in pocket depths greater than 5 mm the efficiency of removal of subgingival plaque is very difficult to achieve (Waerhaug, 1978). One may speculate that the effectiveness of the plaque and calculus removal must have been significant in our cases to demonstrate such dramatic healing. It is also interesting to note that the patient in case 1 tolerated the deep instrumentation and ceramic crown construction without local anesthesia.

Fig 7 Case 3 (tooth 46) Initial.

Fig 8 Case 3 (tooth 46) 14 months.

One of the main goals of periodontal therapy is to suppress or eradicate periodontal pathogens (Slots et al, 2002). Systemic antibiotics may help in controlling periodontal disease and enhancing clinical outcomes by killing periodontal pathogens out of reach of dental instruments, antiseptics and/or bacteria invading the gingival tissues. Due to a high level of attachment loss and general disease activity, all the patients in these case reports received a systemic course of antibiotics in conjunction with the root planing procedures.

The positive clinical effects of two adjunctive systemic antibiotic regimes combined with non-surgical therapy were recently reported by Kwan et al. In a 1-year clinical study, two hundred and three consecutive patients were treated by full mouth debridement plus a short course of antibiotics. Patients received either metronidazole 250 mg t.i.d. for 5 days, or metronidazole 250 mg t.i.d. and amoxicillin 250 mg t.i.d., for 7 days. They concluded that probing depth reduction was significantly greater following full mouth micro ultrasonic debridement and a 7-day course of systemic metronidazole plus amoxicillin, than full mouth micro ultrasonic debridement plus a 5-day course of metronidazole. The metronidazole /amoxicillin group experienced an 87.95% versus a 79.86% (for the metronidazole only group) reduction of initial probing depths from 6–12 mm to ≤ 5 mm after 12 months (Kwan et al, 2000).

Systemic antibiotic therapy may also contribute to improved radiographic alveolar bone levels in certain types of periodontal diseases. Metronidazole therapy for 10 days (Saxen et al, 1993) and doxycycline for 12 days (Saxen et al, 1990) in juvenile periodontitis patients may significantly increase the proportion of sites demonstrating less than 25–30% alveolar bone loss and decrease the number and the proportion of sites showing a greater amount of bone loss. Soder however, found that such positive results did not occur in smokers (Soder et al, 1999). It was interesting to find such significant osseous fill on tooth 36 in the patient in Case 1 who smoked 10 cigarettes per day.

An additional adjunctive therapy used with the root planing procedures in the three cases was irrigation with povidone-iodine (PVD-I) and hydrogen peroxide. The beneficial effects of PVD-I may have occurred since it is microbicidal for gram – positive bacteria, fungi, mycobacteria, viruses, and protozoans. In terms of method of action, Schreier et al reported that electron microscopic and biochemical assessments supported the contention that PVD-I interacted with the cell walls of bacteria causing a transient or permanent pore formation. As a result, there occurred a loss of cytoplasmic material, and deactivation of enzymes due to direct contact with iodine. In addition, PVD-I could also cause coagulation of nuclear material without rupturing cell walls thus creating further damage to the cell. (Schreier et al, 1997).

The combination of PVD-I and hydrogen peroxide as an adjunct in periodontal therapy has been previously reported. Clark et al found that PVD-I and PVD-I / 1.5% hydrogen peroxide mouth rinses significantly reduced inflammation and that the greatest reduction of inflammation was obtained by combining hydrogen peroxide with 5% PVD-I (Clark 1989). Maruniak et al evaluated three dental rinses on the impact of plaque accumulation and gingivitis in a group of 71 patients. The authors com-

mented on the 'synergistic' effect in reducing plaque and gingivitis noted when a 5% PVD-I and a 1.5% hydrogen peroxide rinse was used (Maruniak et al, 1992). The combination PVD-I and hydrogen peroxide irrigation used in our cases may have provided a similar synergistic effect, and contributed to the significant positive responses noted.

The povidone-iodine rinse (0.5%) used in our study had a lower concentration than those reported in the previous studies after equal dilution with hydrogen peroxide. Rosling et al. conducted 3 studies to investigate the benefits of topical antimicrobial agents as adjuncts to mechanical subgingival debridement. Overall, those sites with initial probing depths ≥ 7 mm and irrigated with PVD-I (0.5%) demonstrated approximately 3 mm of attachment gain versus a little less than 2 mm in the other treatment groups (estimated from a graph). The clinical improvement supported the significant anti-infective benefit of PVD-I (0.5%) with root planing procedures (Rosling et al, 1986). The beneficial effects of PVD-I in conjunction with root debridement were reported in a more recent study conducted by Rosling et al (2001). The study assessed the effect of topically applied 0.1% PVD-I, used as an adjunct both during basic non-surgical therapy and at re-treatment during the long-term maintenance of patients with advanced periodontal disease. When compared to a control group (debridement without topical 0.1% PVD-I application), the topical application of 0.1% PVD-I in conjunction with mechanical root debridement resulted in a further improved outcome of therapy over the 12-year observation period.

Listerine was used as an adjunct for plaque control in all three cases. The Listerine was recommended in Case 1 because the patient was a smoker and less stain accumulation would be expected with the product, than with chlorhexidine use. Listerine was also recommended for the patients in Cases 2 and 3. The patient in Case 2 reported an adverse reaction to chlorhexidine while the patient in Case 3 was not compliant in the use of the chlorhexidine gel after a few months of use due to the taste.

Studies evaluating the efficacy of Listerine antiseptic have shown that plaque reduction has ranged from 20–34% and gingivitis reduction from 28%–34% when the Listerine rinse was used twice-daily following tooth brushing. (Fine et al, 1994; Fornell et al, 1974; Lamster et al, 1983; Seiger et al, 1983). Both statistically as well as clinically significant reduction in plaque index, gingival index, and bleeding index were observed in the Listerine group verses the placebo group. Another clinical study evaluating the in vivo interproximal bactericidal efficacy of Listerine antiseptic found a 43.8% reduction in recoverable plaque reduction. The study suggested that the clinical effectiveness of the essential oil mouth rinse against plaque and gingivitis might be attributable to the rapid kill and plaque permeabilizing properties of the formulation (Charles et al, 2000).

An additional beneficial clinical effect may have been rendered by the 0.12% chlorhexidine gel prescribed in Case 3 during the initial therapy. The 0.12% chlorhexidine gel (compounded by our pharmacist) was prescribed to reduce the number of periodontal pathogens in the oral cavity. The 0.12% chlorhexidine gel is a diphenyl compound antiseptic that demonstrates activity mainly against bacteria with limited activity against viruses (Slots et al, 2002). It is has been the authors' experience that the advantage of the gel formulation is that it may be applied to a local area for direct effect and also tends to minimize the tendency of stain formation on the teeth.

The efficacy of chlorhexidine as an adjunct in full mouth disinfection has been compared to full mouth root planing without chlorhexidine (Quirynen et al, 2000). During the first two months of the 8 month study when chlorhexidine was administered, patients undergoing full mouth disinfection manifested greater probing depth reductions, increased gains of clinical attachment, and an increased micro flora reduction at an earlier time than individuals treated with full mouth root planing alone. Quirynen found that there were no significant differences in clinical outcomes after an 8-month evaluation period. The authors questioned the need for adjunctive chlorhexidine therapy to enhance clinical responses with full mouth root planing procedures.

Finally, another factor contributing to the osseous fill seen in these cases may be the morphology of the vertical defects. Klein and his group investigated the radiographic defect depth and width for prognosis and description of periodontal healing of infrabony defects in 24 patients. The patients had advanced chronic periodontitis and were treated with guided tissue regeneration (GTR). They found that narrow (< 26 degrees) and deep (≥ 3 mm) infrabony defects respond radiographically and to some extent clinically more favorably to GTR therapy than wide and shallow defects. They reported that the depth of the infrabony component

was a stronger prognostic parameter than the defect angle (Klein et al, 2001).

The morphology of bony defects that may respond positively to root planing procedures requires further investigation.

The authors feel that these case reports demonstrate that some clinical periodontal cases are retrievable with root planing and adjunctive therapy. The combination therapy appears to be an impetus for impressive clinical and radiographic responses to non-surgical therapy, even in a patient who is a smoker. Whether the healing responses obtained can mostly be attributed to systemic antibiotic therapy, irrigaton with PVD-I/hydrogen peroxide, topical antiseptic application, the degree of the clinician's skill improved oral hygiene, or the morphology of the defects treated remains to be discovered.

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