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AM Genovesi
M Ricci
O Marchisio
U Covani

Periodontal dressing may influence the clinical outcome of non-surgical periodontal treatment: a split-mouth study

Authors' affiliations:
AM Genovesi, *M Ricci*, *O Marchisio*, *U Covani*, Istituto Stomatologico Tirreno, Versilia General Hospital, Camaiore, Italy
M Ricci, *O Marchisio*, Nanoworld Institute Genoa, Genoa, Italy
U Covani, Prosthetic Dentistry, University of Pisa, Tuscany, Italy

Correspondence to:
M. Ricci
Istituto Stomatologico Tirreno
Versilia General Hospital
Camaiore
Italy
Tel.: +39 0584 6059888
Fax: +39 0584 6059889
E-mail: ricci.massimiliano@yahoo.it

Abstract: *Introduction:* After scaling and root planning (SRP), healing induces the formation of a junctional long epithelium rather than a new connective attachment. We hypothesize that the placement of a periodontal dressing will be able to prevent detachment of coagulum inducing proper healing and improving periodontal parameters. *Materials and methods:* This split-mouth study included 30 patients with periodontitis with ages ranging from 35 to 70 years. Probing pocket depth (PD), probing attachment level (PAL), bleeding on probing index (BoP) and plaque index (PI) were assessed before and after therapy. The group of patients received SRP in a span of 24 h. Then, a periodontal dressing was applied on the test side and it was removed after 1 week. *Results:* Control group: The difference between PD values at baseline and after therapy was 1.6 ± 0.6 mm. The difference in PAL (ΔPAL) measurement was 1.4 ± 0.4. Test group: there was a greater PD reduction, this being 2.4 ± 0.6 mm on average. The difference in PAL was 2.5 ± 0.4 mm. *Conclusions:* Our results clearly suggest that the use of a periodontal dressing improves the periodontal parameters after an SRP procedure. This is probably due to clot stabilization and prevention of bacterial colonization during wound healing.

Key words: dressing; periodontal healing; root planning; scaling

Introduction

Periodontitis is an immuno-inflammatory disease characterized by the loss of tooth supporting structures, including the connective tissue attachment and the alveolar bone. Plaque and bacteria are generally recognized as the primary cause of the periodontal disease (1, 2).

Currently, scaling and root planning (SRP) represent the most widely used procedure in the treatment of the periodontitis (3). The main goal of SRP is the removal of the components of the subgingival biofilm, which play a major role in the initiation and progression of the disease (2).

However, this procedure creates the development of a wound in the periodontal area. It is well known that its healing induces the formation of a junctional long epithelium rather than a new connective attachment (4).

The wound healing process in non-oral sites has been studied carefully (5). As a matter of principle, after an injury, a blood clot is formed. This

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clot has two main functions. First, it is able to protect tissues. Second, it provides for a provisional matrix that links firmly two different surfaces (bone and tooth) allowing the migration of undifferentiated cells (5).

A large number of inflammatory cells populate the clot within hours, preventing bacterial colonization of the wound. In the first 3 days, this allows the inflammatory response to decrease in intensity and macrophages to migrate into the wound secreting polypeptides involved in the successive phases of healing (5). These cells can play a key role in the formation of the granulation tissue, inducing the healing through liberation of growth factors and cytokines. As a consequence, fibroblasts produce a new collagen-rich matrix, and allow endothelial cells to migrate and form new vascular vessels (6).

With regard to epithelial cells, they proliferate from the basal layer and migrate through the fibrin clot to seal the epithelium fracture. Maturation of granulation tissue will lead to 'regeneration' or 'reparation' of the wound. Two conditions will make regeneration rather than reparation possible: availability of requested cells and presence/absence of cues and signals necessary to stimulate these cells (7).

Although the principles of the healing process observed in non-oral sites can be applied to the healing processes after periodontal treatment, some anatomic conditions make oral healing more complex. First, the wound margins are, on one side, from vascular connective tissue and gingival epithelium, and a rigid non-vascular mineralized tooth surface on the other side. Second, it should be kept in mind that the crown of a tooth is exposed in a septic environment, such as the oral cavity, while its root is fixed in the bone, which is an aseptic area (8).

Different healing steps at the dento-gingival interface have been studied by Wikesjö *et al.* using a dentin block placed under a gingival flap in dogs (8). Within few minutes, a fibrin clot is formed close to the root surface. Following this, the traditional events of inflammation process take place. After 7 days, a connective tissue attachment may be seen on the root surface. Within 14 days, the collagen fibres appear to be attached to the dentin firmly (8–10).

The functional integrity of a maturing periodontal wound has been examined by several authors. They pointed out the fact that after periodontal surgery, the tensile strength at the gingival root interface increases from 200 g at the third day to 340 g at the seventh day post-surgery, reaching 1700 g after 14 days (11).

This suggests that a periodontal wound might not reach functional integrity until 2 weeks post-surgery. Therefore, it is reasonable to suppose that a gradual increase in the force applied on the wound can jeopardize the formation of a new connective tissue attachment, leading to inappropriate healing with the formation of an epithelial attachment. Literature does not indicate clearly whether the use of some devices, such as periodontal dressing, could provide any advantage in the healing process.

The use of a product derived from eugenolate to protect the wound area was introduced for the first time in 1923 by Ward (12). In spite of some authors pointing out the benefits derived from the use of a periodontal dressing after treatment, current therapy studies are often lacking advice to deliver post-therapeutic care with this technique (13).

Currently, the indications for the use of a periodontal dressing are limited. For instance, its use is suggested in repositioned flap surgery to protect the flap from displacement (14). Apart from Sigusch *et al.*, no author recommends its use after non-surgical therapy (13).

In the past, other authors discussed the positive effects of dressing. Asboe-Jorgensen suggested its use especially for improving patient comfort (15). On the other hand, Ramfjord stated that closed curettage could induce periodontal trauma that leads to a relatively wide dehiscence of the buccal and lingual papillae. Therefore, the soft tissue should be brought into close contact with the tooth after the treatment, either by interproximal sutures or by a firm dressing (16, 17).

Moreover, Pritchard and Sachs *et al.* observed advantages of periodontal dressing in terms of preventing persistent bleeding and keeping away mechanical influences during the healing process (18, 19). Finally, Plagmann observed an important effect in the use of the periodontal dressing. He supported the idea that coagulum should be stabilized to prevent any movement and to obtain the connective attachment to the hard tissue (17).

Thus, the rationale of this study is that the application of a periodontal dressing after the scaling and root planning procedure in patients suffering from moderate-to-severe periodontitis can stabilize the clot and protect it from forces usually created during daily movements, such as talking and chewing.

The use of periodontal dressing could protect the wound, and the formation of a new connective attachment could be achieved. Moreover, probing depth (PD) and probing attachment level (PAL) values may be improved. The primary aim of this study was to compare, in a split-mouth design, scaling and root planning alone versus scaling and root planning with the aid of periodontal dressing, to understand better if the clinical parameters using a periodontal dressing were improved.

Materials and methods

Patients with a diagnosis of moderate-to-advanced periodontitis were included in this double-blinded split-mouth study. All patients were selected among subjects with periodontitis evaluated at the Dentistry department at the Versilia Hospital (Italy).

Patients with ages ranging from 35 to 70 years and with a PD greater than 5 mm with bleeding on probing in more than 30% of sites were included. Patient had to be non-smokers or smokers of less than 10 cigarettes per day. All subjects included in the study matched the diagnostic criteria for adult periodontitis according to the new nomenclature (21).

Patients who received antibiotic therapy during the previous 6 months and patients with dental implants were excluded. Moreover, patients with systemic diseases were not included. Informed consent was obtained from all participants.

After inclusion, parameters such PD, PAL, bleeding on probing index (BoP) and plaque index (PI) were measured by a dentist using a Michigan periodontal probe (Patterson Dental, St. Paul, MN, USA). All evaluations were made at six sites per tooth: mesial-buccal, buccal and distal-buccal site, and mesial-lingual/palatal, lingual/palatal, distal-lingual/palatal site, maintaining the probe close to the root surface and in line with the long axis of the tooth. The operator was instructed to apply a force of 30 g.

After determining the periodontal measurement, the first step consisted of an oral hygiene treatment (Fig. 1). In addition, a dental hygienist provided instructions to the patient about the Bass technique. After a week, the second treatment step was carried out. Patients received periodontal therapy consisting of SRP in a span of 24 h, followed by curettage of the gingival epithelium for each pocket, performed by the same dentist. Curettage allowed the clot to remain in the periodontal pocket so that the healing process was encouraged.

At the end of the treatment, a test side and a control side were selected for each patient randomly by a dental hygienist. A specific software was used to obtain a randomization list (Random Allocation Software version 1.0, downloadable on http://mahmoodsaghaei.tripod.com/Softwares/randalloc.html). After then, in the upper and lower arches, on the test side only, a periodontal dressing, such as Coepak®, was applied carefully (Figs 2 and 3 to the site). Whenever possible, care was taken to prevent saliva access to the treated areas. It is important to remember that Coepak® is an eugenol-free material for use as a periodontal dressing and it adheres excellently to the tooth surfaces.

A dental assistant mixed the material according to the manufacturer's indications. Application was performed by a dental hygienist and started from the crown area. In this way, it was easy to adapt the dressing to the papillae with slight pressure in the interproximal space area. Each patient was instructed to maintain a good level of oral hygiene, but to avoid the periodontal dressing area during the first week.

After a week, the periodontal dressing was removed from the test side, and oral hygiene instructions were given to the patients. The test side and the control side were annotated in a special form by the dental hygienist and therefore the dentist was not aware of where the dressing was placed. Two months later, all clinical measurements, including an oral hygiene index, were carefully evaluated by the same blinded dentist (Fig. 4). Statistical analyses were performed. Average, standard

Fig. 1. Photographs taken after oral hygiene treatment. Soft tissues appeared oedematous and full mouth bleeding score was above 30%.

Fig. 2. After scaling and root planning, a blood clot is formed in the periodontal pocket. It is reasonable to think that periodontal dressing may stabilize the clot so that primary wound healing could be obtained. However, if the blood clot is not stable, the healing process will not happen in an appropriate way driving to the formation of a long epithelial attachment.

Fig. 3. Periodontal dressing was placed on both vestibular and palatal/lingual sides of test site.

Fig. 4. Final photographs after two months showed a reduction in oedema and improvements in soft tissues conditions on both test and control sides confirming the idea that periodontal treatments were given successfully.

deviation and median for probing deep pockets, recession and clinical attachment level were calculated. The Fisher test was used to compare test and control results statistically.

Results

According to the inclusion/exclusion criteria from 53 patients seen during the period of this study among the subjects checked at the Dentistry department at Versilia Hospital (Italy), 30 patients with a diagnosis of moderate-to-advanced periodontitis were included in this double-blinded split-mouth study. All patients belong to Caucasian race and were on average 52.3 ± 6.0 years old. Of the total 30 patients, 18 were women and 12 were men.

The first therapy step included motivation and complete removal of supragingival calculus and plaque. This was an essential prerequisite to start the second treatment step, consisting of SRP of the entire mouth. The Full Mouth Plaque Score (FMPS) was detected at baseline and after 2 months in each patient. Results showed a large reduction in comparison with pretreatment values, with a rate of 24.7% at baseline, which decreased to a rate of 4.8% after 2 months. No doubt, this was due to the efficient oral hygiene regime and the short period of time between the first step and the evaluation (Fig. 5).

Similarly, values of the Full Mouth Bleeding Score (FMBS) were reduced after periodontal treatment. In fact, the results observed after two months with an average of 5.3% (35.3% at the baseline) confirm the success of the treatment (Fig. 6).

Fig. 5. This figure shows the values of bleeding on probing at the baseline and after two months in the treated group.

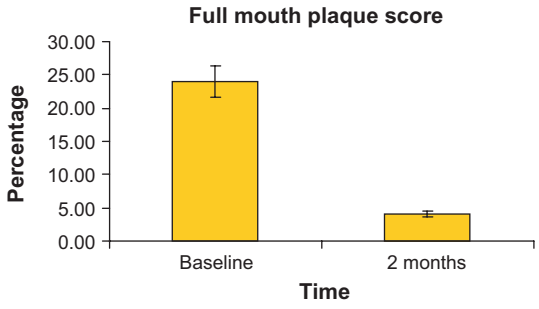

Fig. 6. Full mouth plaque scores are shown above at the baseline and after two months. Great improvement in oral hygiene levels has been achieved.

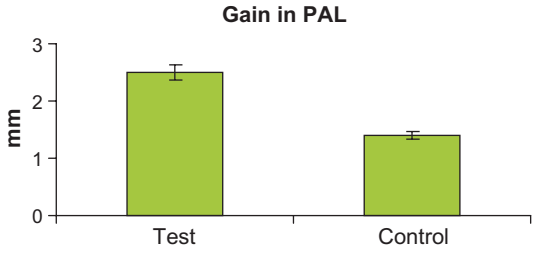

Fig. 7. A great reduction in PD values before the treatment and 2 months later is shown.

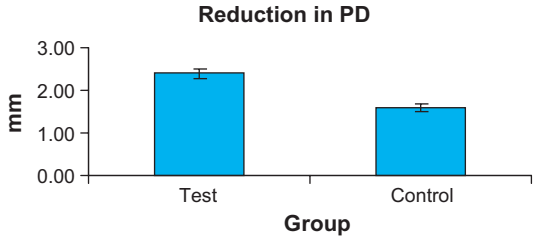

Fig. 8. Gain in attachment or better, the differences between PAL values at the baseline and two months later are displayed.

After 2 months, we also found an increase in PD and PAL compared with the baseline data. Great improvements were observed in both the test and control sides indicating that the therapy was conducted successfully. On the control side, the difference between PD values at baseline and after therapy was 1.6 ± 0.6 mm, demonstrating that SRP procedures were successful in reducing pockets. On the other hand, the test side showed more PD reduction, with an average of 2.4 ± 0.6 mm, confirming that PD was reduced more in the test area. Figure 7 shows the difference between pre- and post-treatment values.

Similar results were found for PAL values. Indeed, the gain in attachment after periodontal treatment was improved on both sides. However, better results were obtained on the test side compared with the control side. Differences in PAL (ΔPAL) measurements were 1.4 ± 0.4 on the control side and 2.5 ± 0.4 mm on the test side (Fig. 8). Differences between the test and control side were statistically significant according Fisher's test ($P < 0.05$).

Discussion

Periodontal healing and regeneration were investigated by various authors. In particular, periodontal regeneration is defined as 'the reproduction or reconstitution of a lost or injured part so that form and function of lost structures are restored. As a consequence, periodontal regeneration includes regeneration of alveolar bone, cementum, periodontal ligament and gingival' (22).

Although the famous experiments of Nyman and Karring elucidated the concepts that rule periodontal regeneration,

suggesting that only the cells of the periodontal ligament have the capacity to regenerate the attachment, other authors indicated that various factors can contribute to the re-formation of attachment (23–28).

Bacteria colonization, root surfaces condition, adaption of the flap and morphology of the defect are only some examples of the multi-factorial aetiology and pathogenesis of periodontal diseases. Moreover, the amount and disposition of the residual gingival and the width of keratinized tissue must be taken into account because they may contribute to periodontal disease progression (29, 32). On the other hand, the width of the remaining attached gingiva is commonly not considered as critical to the outcome of therapy (30, 31). Finally, the literature also shows that the number of walls of the defects needs to be considered because they are able to protect the coagulum from mechanical forces (such as speaking and chewing) and, as a consequence, the stability of the clot could be increased when the number of walls is greater (33, 34).

Altogether, these studies point out the crucial importance of the adhesion and of the maturation of a stable fibrin clot for the formation of the connective tissue attachment over a long junctional epithelium. Our results clearly suggest that maintaining a periodontal dressing for 7 days can improve the periodontal parameters after an SRP procedure.

On the basis of the study of Sigusch *et al.*, which observed less satisfying results in the group of patients who removed the dressing after only 3 days, we decided to maintain the periodontal dressing (CoePak®) for 7 days in all patients (35).

With regard to gain of attachment, our data reveal an important difference between the test side and the control side. On the test side, we obtained a gain of 2.5 mm on average as against 1.4 mm on the control side. Literature indicates that after a scaling and root planning procedure, an evaluation after a few months can show evidence of a gain in attachment up to 0.55 mm for 4–6 mm pockets and 1.19 mm in case of > 7 mm pockets (36). Considering that our patients had more than 30% of pockets > 5 mm, the results on the control side can be considered more than satisfying. On the other hand, the test side showed a greater gain, supporting the idea that the placement of a dressing using a slight pressure to adapt it to the interproximal area, allows soft tissue adhesion to the root surface and to the hard tissues allowing important stability.

In fact, Linghorne and O'Connell observed many years ago that a *lack of stability* of the wound could drive the formation of a long junctional epithelium (37). Wikesjö *et al.* also confirmed that formation of a connective attachment on the root surface following reconstructive periodontal surgery is critically dependent on the stability of the wound (38).

Hiatt highlighted the fundamental role of the adhesion and the stability of the fibrin clot to the root surface so as to prevent the apical migration of the gingival epithelium (11). On this basis, the junctional epithelium commonly observed after periodontal treatment seems to be a failure in the healing process (20, 39).

Besides stability, the periodontal dressing could offer other advantages such as a missing penetration of the fluids and the bacteria in the treated area. In fact, it is important to remember that after an SRP procedure or a surgical intervention, the periodontal pocket is exposed directly to the oral environment. As a consequence, the bacteria could re-colonize *en bloc* the same periodontal pockets, and the root surface and the healing may be placed at risk (40).

Our results also show an important reduction in the value of PD after the treatment on both the test and control sides. Reduction in PD values following mechanical instrumentation results from a combination of gain of attachment and gingival recession (41).

The reduction in PD on the test side is 2.4 mm in contrast to the 1.6 mm on the control side. Literature indicates that for those pockets initially measuring 4–6 mm, the mean reduction in PD is 1.29 mm, whereas for pockets above 7 mm, the reduction is 2.16 mm (36). The values on the control side seem to be in accordance with the literature, whereas the test side shows a greater reduction.

According to Sigusch *et al.*, application of a dressing could have reduced the inflammation response in the periodontal area (35). This hypothesis confirms that reduction in PD values on the test side is due to both a real gain in attachment (as discussed above) and a reduction in gingival oedema.

With the limitations of our study, we believe that our findings provide novel insights into use of a periodontal dressing. In fact, as we demonstrated, the periodontal dressing can improve the outcome of the non-surgical periodontal treatment through the stabilization of the clot so that ideal periodontal healing can be achieved.

However, further randomized, double-blinded, full-mouth clinical studies and histological studies are necessary to confirm our results and to clarify which mechanisms are involved in periodontal wound healing after SRP, and whether periodontal dressing could actually improve healing from a histological point of view.

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