Research Article

JPIS Journal of Periodontal & Implant Science

J Periodontal Implant Sci 2011;41:92-97 • doi: 10.5051/jpis.2011.41.2.92

# Comparative study on the results of non-surgical periodontal treatment according to the location of the affected site

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**Purpose:** The present study was performed to compare the treatment outcomes of non-surgical periodontal treatment according to the distribution of attachment loss of a given patient.

**Methods:** Forty-five patients with moderate to severe periodontitis were divided in two subgroups; Group I patients with teeth manifesting attachment loss of ≥6 mm at one or more sites on the buccal/labial aspect while maintaining an attachment level ≤5 mm at the lingual/palatal aspect, Group II patients with teeth manifesting an attachment level ≥6 mm at more than one site on the lingual/palatal aspect while maintaining an attachment level ≤5 mm at the buccal/labial aspect. The probing pocket depth, probing attachment level, tooth mobility, and chewing discomfort were recorded at baseline and 6 months examinations following non-surgical periodontal therapy.

**Results:** The buccal/labial surfaces of teeth with moderate to severe periodontitis in Group I patients demonstrated a greater amount of pocket reduction, gain of attachment level, and tooth mobility reduction than the lingual/palatal aspects of teeth examined in Group II patients.

**Conclusions:** Within the limits of the present study, the patients demonstrating attachment loss ≥6 mm at buccal/labial surfaces responded better to the nonsurgical periodontal therapy than those demonstrating comparable attachment loss at lingual/palatal surfaces.

**Keywords:** Periodontal pocket, Periodontitis, Prognosis.

## INTRODUCTION

Chronic periodontitis is an inflammatory disease of the supporting tissue of the teeth resulting from bacterial inflammation that is characterized by the formation of an alveolar pocket, the progressive loss of the periodontal ligament and alveolar bone, and gingival recession [1]. Periodontal disease is a chronic inflammatory disease initiated primarily by a complex bacterial biofilm in the subgingival niche and is modified by a variety of complicated risk factors including smoking, genetic factors, systemic factors, and psychosocial and behavioral factors [2]. Periodontitis starts most commonly in those aged 20 to 30 years and is classified by the distribution of the affected site and the severity. A cross-sectional study reported that only 10% of the total adult population has healthy periodontal tissue, 80% are affected by moderate periodontal disease, and 10% have severe periodontitis [3].

The treatment of chronic periodontitis involves reconsti-

**Received:** Jan. 21, 2011; **Accepted:** Mar. 17, 2011

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pISSN 2093-2278
eISSN 2093-2286

tuting a biocompatible environment through the removal of the subgingival bacterial biofilm and debridement of the mineralized posits on the root surface, with an ultimate goal of preventing inflammatory destruction [4], reducing the periodontal pocket depth, and gaining or maintaining the level of connective tissue attachment. Decreasing the amount or modifying the composition of bacterial biofilm can result in the elimination of gingivitis and reduction of bleeding on probing [5,6].

Periodontal diseases are managed primarily by two modalities: surgical therapy and non-surgical therapy. Non-surgical therapy involves scaling and root planing with hand and/or ultrasonic instruments as well as oral hygiene instruction. Axelsson and Lindhe [7], and Bardersten et al. [8] reported that non-surgical therapy resulted in a significant reduction in pocket depth, a gain in the level of attachment, and a decrease in gingival inflammation. Surgical treatment is scheduled according to the results based on a reevaluation following the non-surgical therapy to further eradicate the remaining pocket and inflammation, to create a healthy environment, and to stimulate regenerative potential of periodontium. Rosling et al. [9] observed that the pocket depth was significantly reduced, the level of attachment was enhanced, and considerable amount of osseous fill was obtained after surgical periodontal therapy.

An in-depth understanding of the prognostic factors affecting the results of periodontal therapy enables dentists to choose an appropriate therapeutic modality for obtaining better results. The relevant factors, such as the patient, tooth, or affected sites on the tooth, may affect the treatment result [2,10,11]. Researchers have listed various prognostic indicators for periodontal therapy including initial probing pocket depth, biofilm or bleeding on probing, existence of furcation, and location of the affected site, smoking, level of plaque accumulation, and shape of the tooth [11-14]. Most recently, Kim et al. [15] in their study on the attachment loss pattern of extracted teeth caused by periodontitis reported that the palatal/lingual surfaces of the maxillary and mandibular premolars and molars showed a significantly higher rate of attachment loss. This indicates that teeth with a higher rate of attachment loss on the palatal/lingual surface may be more liable to a poor prognosis.

In many clinical situations, the reaction to periodontal treatment of a tooth affected by periodontitis may differ according to the attachment loss pattern on the buccal/labial or lingual/palatal surface of a given single tooth. However, there are no previous data reporting the results of periodontal treatment according to the distribution pattern of attachment loss with specific respect to buccal or lingual surface of a given single tooth. Hence, the present study was designed to compare the results of non-surgical periodontal treatment for a single tooth according to the attachment loss pattern on the buccal/labial or the lingual/palatal surface.

## MATERIALS AND METHODS

### Subjects

Forty patients with moderate to severe periodontitis (31 males, 14 females; mean age, 48.2), who have visited the Periodontics Specialist Clinic in the Department of Periodontology at the Pusan National University Dental Hospital, were included in the study. The number of target teeth was 113 excluding wisdom teeth (maxilla, 36; mandible, 77). The exclusion criteria were as follows:

1) patients with severe systemic disease that may influence the results (hypertension, diabetes, cardiovascular disease, and pregnancy).

2) patients who had previously undergone periodontal treatment in the last 5 years.

3) patients who were under medication for the treatment of periodontal disease.

4) patients with a smoking habit.

This study was approved by the Institutional Review Board of Pusan National University Hospital.

### Selection of the experimental group

The experiment group was divided into 2 patient groups according to the pattern of attachment loss based on the initial attachment level in six sites (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, and distolingual) on a single tooth: Group I patients with teeth manifesting an attachment loss of $\geq$6 mm at one or more sites on the buccal/labial aspect while maintaining attachment level $\leq$5 mm at the lingual/palatal aspect, Group II patients with teeth manifesting an attachment level $\geq$6 mm at more than one site on the lingual/palatal aspect while maintaining an attachment level $\leq$5 mm at the buccal/labial aspect.

### Non-surgical periodontal therapy

At the baseline examination, scaling and tooth brushing instruction were performed on every target tooth. The full mouth was divided into six segments and patients received subgingival root planing at 2-week intervals. A clinical reevaluation was made at 6 months after non-surgical periodontal therapy. The reinforcement of the supragingival plaque control regimen was made on each visit whenever necessary.

### Measurement of clinical indexes

The following clinical indexes were recorded at the pre-

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treatment baseline and 6 months after the non-surgical periodontal treatment, respectively: probing pocket depth, probing attachment level, tooth mobility, and discomfort on chewing. The probing pocket depth and probing attachment level were measured with a periodontal probe (PGF-W, Osung MND Co., Kimpo, Korea), which measured to the nearest 1 mm unit. For teeth under crown restorations, the lingual margin of the crown was set as the reference point of measurement. Tooth mobility was assessed using the Miller's index as follows: 0´- no tooth mobility, 1´- up to 1 mm of movement in a horizontal direction, 2´- greater than 1 mm of movement in a horizontal direction, and 3´- vertical movement. The presence or absence of discomfort on chewing was classified as 1 or 0, respectively. All clinical measurements were made by the same examiner three times on each experimental site to avoid or minimize the inter-examiner and intra-examiner measurement error.

### Statistical analysis

A Student's *t*-test was used to compare the changes between the two experiment groups using the SPSS ver. 12 (SPSS Inc., Chicago, IL, USA). A *P*-value <0.05 was considered significant.

## RESULTS

The number of target teeth was 113, including 45 teeth of 21 patients in Group I and 68 teeth from 24 patients in Group II.

### Changes in probing pocket depth

After non-surgical periodontal treatment, the probing depth decreased by 1.00±0.95 mm compared with the first visit (Table 1). The decrease in probing depth of Group I patients (average, 1.32±1.04 mm) was significantly higher than that in Group II patients (average, 0.79±0.83 mm) (*P*<0.01).

The buccal/labial aspect in Group I patients and the lingual/palatal aspect in Group II patients, which manifested greater attachment loss and probing pocket depth, showed a greater amount of pocket depth reduction than those of the counterparts. Moreover, the probing depth of the buccal/labial aspect of Group I patients showed significantly greater reduction than that of the lingual/palatal aspect of Group II patients (*P*<0.01), both having been comparable at the baseline examination.

### Changes in probing attachment level

In both experimental groups there was an average attachment gain of 0.28±0.59 mm. The buccal/labial aspect of Group I patients and lingual/palatal aspect of Group II patients, which manifested the greater attachment loss and pocket depths, showed a larger amount of attachment gain than those of the counterparts. However, there was little change in the level of attachment in the lingual/palatal aspect of Group I patients and the buccal/labial aspect of Group II patients, which showed a smaller degree of attachment loss and probing pocket depth at baseline examination (Table 2). The gain of the attachment in the buccal/labial aspect of Group I patients (average 0.50±0.62 mm) was significantly greater than that in the lingual/palatal aspect of Group II patients (average 0.28±0.59 mm, *P*<0.01).

### Reduction in tooth mobility

Groups I and II together showed an average tooth mobility reduction of 0.42±0.51 mm (Table 3). Group I patients showed a significantly greater reduction in tooth mobility (average 0.71±0.51) than did Group II patients (average 0.22±0.42, *P*<0.01).

**Table 1.** Changes in probing pocket depths (baseline-6 months).

| Group | N | Site | Mean±SD (mm) | |
|---|---|---|---|---|
| | | | Baseline probing depth | Changes after treatment |
| Group I | 21 | Buccal/labial | 5.71±1.91 | -2.04±0.88[a] |
| | | Lingual/palatal | 3.29±0.94 | -0.60±0.58 |
| | | Total | 4.50±1.93 | -1.32±1.04[b] |
| Group II | 24 | Buccal/Labial | 2.79±0.97 | -0.27±0.51 |
| | | Lingual/Palatal | 5.32±1.67 | -1.31±0.78[a] |
| | | Total | 4.06±1.86 | -0.79±0.83[b] |
| Total | 45 | | 4.23±1.90 | -1.00±0.95 |

N: Number of patients.
[a]Significantly different between the buccal/labial sites of Group I and lingual/palatal sites of Group II (*P*<0.01). [b]Significantly different between Groups I and II (*P*<0.01).

**Table 2.** Changes in the probing attachment level (baseline-6 months).

| Group | N | Site | Mean±SD (mm) | |
|---|---|---|---|---|
| | | | Baseline level of attachment | Changes after treatment |
| Group I | 21 | Buccal/Labial | 7.29±1.36 | 0.93±0.54[a] |
| | | Lingual/Palatal | 4.18±0.81 | 0.07±0.33 |
| | | Total | 5.73±1.92 | 0.50±0.62[b] |
| Group II | 24 | Buccal/Labial | 4.21±0.82 | -0.06±0.38 |
| | | Lingual/Palatal | 7.22±1.16 | 0.34±0.56[a] |
| | | Total | 5.71±1.81 | 0.23±0.50[b] |
| Total | 45 | | 5.72±1.85 | 0.28±0.59 |

N: Number of patients.
[a]Significantly different between the buccal/labial sites of Group I and the lingual/palatal sites of Group II (*P*<0.01). [b]Significantly different between Groups I and II (*P*<0.01).

**Table 3.** Changes in the degree of tooth mobility.

| Group | N | Mean ± SD (mm) | |
|---|---|---|---|
| | | Baseline tooth mobility | Changes after treatment |
| Group I | 21 | 0.78 ± 0.60 | -0.71 ± 0.51[a] |
| Group II | 24 | 0.85 ± 0.74 | -0.22 ± 0.42[a] |
| Total | 45 | 0.82 ± 0.68 | -0.28 ± 0.59 |

N: Number of patients.
[a]Significantly different between Group I and Group II ($P<0.01$).

**Changes in discomfort on chewing**

Of 27 teeth of Group I and II showed discomfort on chewing at baseline, discomfort on chewing was resolved after non-surgical periodontal treatment for all but one in Group II (26 teeth, 96.3%). The average reduction on each tooth in Groups I and II was -0.27 ± 0.45 and -0.21 ± 0.41, respectively, and there was no significant difference ($P>0.05$) between the two.

## DISCUSSION

In the present study, the decrease in the periodontal pocket was 1.00 mm and the gain in the level of attachment was 0.28 mm 6 months after non-surgical periodontal treatment, which was similar to the findings reported by Kaldahl et al. [16] and Kim and Chung [17]. The decrease in periodontal pocket depth in Groups I and II was 1.32 mm and 0.79 mm, respectively, while the gain in the level of attachment in Groups I and II was 0.50 mm and 0.14 mm, respectively. Therefore, Group I patients demonstrated significantly greater amount of pocket depth reduction and attachment gain than Group II patients following the non-surgical periodontal treatment ($P<0.01$).

Philstrom et al. [18] reported that there was a larger reduction in pocket depth and improvement in the level of attachment with increasing depth after both surgical and non-surgical therapy. However, teeth with an initial pocket depth <3 mm showed little reduction in the pocket depth or gain in the level of attachment. In the present study, the change in pocket depth and the level of attachment was similar to the their results [18], the treatment outcome being increased with increasing initial probing depth.

The decrease in pocket depth and the level of attachment gain in the buccal/labial site of Group I patients was 2.04 mm and 0.93 mm, respectively. However, the decrease in pocket depth and the level of attachment gain in the lingual/palatal site of Group II patients was 1.31 mm and 0.34 mm, respectively. This phenomenon strongly suggests that teeth with a low level of attachment on the lingual/palatal site may respond more poorly to non-surgical treatment than the teeth with a comparable attachment level on the buccal and labial site in a single tooth, which may pose a critical prognostic value.

Many studies have examined the change in tooth mobility after non-surgical periodontal treatment and have reported a significant decrease in tooth mobility [19-23]. Kerry et al. [21] reported greater improvements in the teeth with high mobility than those with low mobility, and Pang et al. [22] reported that the change in mobility was higher when the tooth had a higher initial probing depth, especially in the early stage after surgery. Moreover, Schulte et al. [24] and Demirel et al. [25] reported that tooth mobility is associated with radiographic bone loss and attachment loss. In the present study, there were significant differences between Groups I and II at six months after non-surgical treatment ($P<0.01$). Groups I and II showed a 0.71 ± 0.51 and 0.22 ± 0.42 decrease in mobility, respectively. Considering the studies of Schulte et al. [24] and Demirel et al. [25], the difference in this study seemed to be associated with the increase in the level of attachment. Therefore, Group I patients, in which there was a greater amount of gain in the level of attachment, showed a better response to non-surgical treatment in terms of tooth mobility than Group II patients. Discomfort on chewing observed at the pre-treatment stage was diminished after non-surgical treatment. However, this result was not significant because only one tooth in Group II showed discomfort on chewing after non-surgical treatment. The changes in the attachment level and tooth mobility might explain why the discomfort on chewing decreased.

The teeth with a greater amount of palatal/lingual attachment loss at baseline examination demonstrated a poorer treatment response than those showing a comparable attachment loss in the buccal/labial aspects. This result can be attributed to many factors, such as crown/root anatomic configurations and angulations, the clinician's accessibility to the area, the ability of the patients to perform optimal oral hygiene, etc. Regarding the anatomical factors, the alveolar bone in the mandible has a thick buccal basal bone in the posterior region while the lingual bony wall is relatively thin, particularly at the level of alveolar crest. In the maxillary molars, the distal root furcation is located at the center of the mesio-distal aspect, while the mesial root furcation is located at two thirds of the palatal aspect. Therefore, if the loss of palatal attachment level is advanced downward, the potential for mesial root furcation involvement increases resulting in a poorer prognosis following nonsurgical therapy [26]. It is possible that the different number of maxillary teeth included in each group might have affected the results because tooth type is also a contributing factor.

Within the context of the present study, it is compelling to define the palatal/lingual attachment loss as one of the prog-

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nostic factors that complicates the treatment results. However, a more systematic study would be required to refine the prognostic factors that may influence the outcomes of nonsurgical periodontal treatment.

In conclusion, when the treatment outcomes were compared in terms of pocket depth reduction, gain in the attachment level and tooth mobility reduction, the patients demonstrating attachment loss ≥6mm at buccal/labial surfaces responded better to nonsurgical periodontal therapy than those demonstrating comparable attachment loss at the lingual/palatal surfaces.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

## ACKNOWLEDGEMENTS

The present study has been supported by a 2009 Clinical Research Grant from Pusan National University Hospital.

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