

Alveolar Bone Loss on Abutment and Non-Abutment Teeth in Relation to Removable Partial Denture Wearing. A Six Month Follow Up Study

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Summary

Loss of interdental alveolar bony septum can be determined directly from a radiograph as the relation between the length of the interdental bony crest of the alveolus to the tooth apex and the distance from the cemento-enamel junction of the tooth to the tooth apex. The aim of this study was to measure the height of the interdental alveolar bone around the abutment and non-abutment teeth in removable partial denture wearers (RPD) on dental panoramic radiographs (DPR) over a period of six months. Twenty RPD patients (5 male, 15 female) participated in the study. The alveolar bone loss measurement was performed on DPRs, using Schei index, on each mandibular abutment and non-abutment tooth on its mesial and distal side, after the RPD delivery and six months later. Recordings of plaque index (PII) were made at the mid-buccal, mid-palatal, mesio- and disto-palatal surfaces of all abutment and non-abutment teeth in the mandible after the RPD delivery and six months later. The results revealed a decrease in Schei index values, on both abutment and non-abutment teeth, which reached a statistically significant level for distal Schei index values of the abutment teeth and mesial and distal Schei index values of the non-abutment teeth ($p < 0.05$) in the 6 month period. There was no statistically significant difference in PII values between the first and the second measurement ($p > 0.05$). We concluded that the decrease in bone support on both abutment and non-abutment teeth was attributed to the high levels of PII and probable low level of oral hygiene than to the RPD loading.

Key words: *alveolar interdental septum, Schei index, plaque index, removable partial denture.*

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Introduction

There are a number of ways to treat the partially edentulous patient in order to restore function, health and aesthetics (1). Overdentures, removable partial dentures, fixed partial dentures or implant-supported overdentures can be constructed, although their effect on the denture bony underlying tissues, as well as on the remaining abutment and non-abutment teeth has been examined (2, 3).

The effect of generalized bone loss on periodontal condition and development of periodontal pockets has also been examined, and the results suggest that there is no clear correlation between periodontal health or number of the teeth and general mineral status of the skeleton (4, 5).

One of the cardinal signs of periodontal disease in adults is alveolar bone loss. Radiography is the method by which this loss can be observed and quantified, and it is considered indispensable for that purpose.

Schei et al. (6, 7) developed a system for evaluating the loss of interdental alveolar bony septum directly from a radiograph as the percentage of the root length of the adjacent tooth. Later some authors modified this approach and used a scale which directly related the percentage length of the interdental bony crest of the alveolus to the total tooth length (8).

The aim of this study was to measure the height of the interdental alveolar bone around the abutment and non-abutment teeth in removable partial denture wearers (RPD) on dental panoramic radiographs (DPR) after the delivery of the dentures and six months later.

Materials and methods

The sample was selected from a group of patients at the Department of Prosthodontics and Department of Periodontics, School of Dental Medicine University of Zagreb. A total number of 20 patients was routinely screened by dental PR prior to the treatment and 6 months after the RPD delivery. The Ethics Committee of the Dental School had approved the study, as the patients were exposed to X-rays for

the necessary diagnosis and future treatment planning. Voluntary written informed consent was obtained from each patient.

Twenty partially edentulous RPD patients (5 male, 15 female) participated in the study. Twelve patients were wearing tooth and mucosa and eight patients were wearing completely mucosa supported removable partial dentures.

The alveolar bone loss measurement was performed on DPRs, using Schei index, on each mandibular abutment and non-abutment tooth, on its mesial and distal side, after the RPD delivery and six months later.

Low quality DPRs (including shadows over the remaining teeth in the mandible or unclear borders of the bone surrounding the remaining teeth in the mandible) were excluded from the study.

Measurements were made of the height of bone lost around each tooth and were expressed as the percent of root remaining in the bone, using the Schei index (6). Measurements from the alveolar crest to the tooth apex were compared with the distance from the cemento-enamel junction to the tooth apex, a difference of 1 mm being considered within normal limits for each surface, and rated as 100% (Figure 1).

The Schei index values for mesial and distal right and left sides of all the abutment teeth in the mandible, immediately after the delivery of RPDs and six months later were calculated separately and their means were recorded. The Schei index values for mesial and distal sides of both right and left side of all the non-abutment teeth in the mandible after the delivery of RPDs and six months later were calculated separately and their means recorded.

Recordings of plaque index (PII) (9) were made at the mid-buccal, mid-palatal, mesio- and disto-palatal surfaces of each abutment and non-abutment teeth after the RPD delivery and six months later. A periodontal probe (University of Michigan "O", with Williams markings, Aesculap, tip diameter 0.5 mm) was used for that purpose.

The PII values for both the abutment teeth in the mandible were calculated, and their mean and the highest value recorded. The same procedure was made for the non-abutment teeth.

Results

One-sample Kolmogorov-Smirnov test revealed all the measured variables were distributed normally ($p > 0.001$). Therefore, parametric tests were used for testing the statistically significant differences.

All the Shei index measurements on both abutment and non-abutment teeth were made on both left and right sides of the mandible. Paired samples t-test did not revealed statistically significant difference between Shei indices measured on the left and right side of the mandible ($p > 0.001$).

Therefore, the mean of the Shei indices measured on the right and left side of the mandible were used in all further statistical analyses.

The results revealed a decrease of Schei index values on both abutment and non-abutment teeth, which reached statistically significant level for distal Schei index values of the abutment teeth and mesial and distal Schei index values of the non-abutment teeth ($p < 0.05$) in the 6 month period (Figure 2, 3, Table 1).

The distribution of PII (in %) - mean values in abutment and non-abutment teeth in the first and second measurement are shown in Figure 4. In abutment teeth PII values were higher in the second measurement and in non-abutment teeth PII values were lower. In abutment teeth more than 50% of the patients had PII score 1, and in non-abutment teeth the majority (50%) had PII score 0.

The distribution of PII (in %) - the highest values in abutment and non-abutment teeth in the first and the second measurement are shown in Figure 5.

There was no statistically significant difference in PII values between the first and second measurement on abutment and non-abutment teeth ($p > 0.05$).

Discussion

This study attempted to define a relationship between the rate of interdental alveolar bone loss on abutment and non-abutment teeth at the delivery of RPDs and after a period of six months of wearing those using dental PRs.

Radiographs continue to play an important role in the diagnosis and management of periodontal dis-

ease, although opinions as to the most appropriate form of assessment vary (10). It is important to recognize the limitations of each technique in terms of resolution, repeatability and accuracy so that radiographs can be correctly interpreted to the benefit of the patient.

Some authors suggest that the periapical radiograph is more successful in detecting periodontal osseous destruction and more accurate in assessing it than DPR (11, 12). The disadvantage of the periapical radiograph is in its small area covering the adjacent tissue around the tooth disabling the comparison between the remaining teeth and the assessment of the distant areas, such as in the whole mandible (lower cortical border of the mandible, mandibular angle). The comparison of two periapical radiographs demands the standardization of the radiographs in order to compensate the differences between the exposure, developing and digitalization of the radiographs.

Molander (13) suggested a combination of a panoramic and periapical radiograph to perform a full-mouth survey. This infers great doses of radiation for the patient.

At the other hand, Akesson (14) suggested that the panoramic radiograph should be the radiographic examination of choice, if increased image quality is achieved.

The dental panoramic radiograph is the method of choice in the assessment of the bone level in the mandible.

Klemetti (15) also used dental panoramic radiographs in the assessment of the ratio of bone support and root height measured separately on mesial and distal sides of the roots according to Salonen (version of Shei index)(16). The results of their study suggested that individuals with high mineral values in the skeleton seemed to retain their teeth with deep periodontal pockets more easily than those with osteoporosis.

The results of this study revealed that Shei index decreased in the period of 6 months of wearing RPDs. Statistically significant difference was found between the first and the second measurement (after the period of 6 months) on both abutment and non-abutment teeth (Figure 2, 3, Table 1; $p < 0.05$).

The results of this study also revealed higher scores for plaque index in abutment teeth (more than 50% of the patients having score 1) and more patients with higher scores six months after the denture delivery on the abutment teeth although the results did not reveal a statistically significant level ($p>0.05$).

There are some investigations which confirm the results of our study, showing correlation between the interdental alveolar bone loss and plaque accumulation.

Walsh et al. (17), using dental panoramic radiographs, found close correlation between the CPITN screening codes and bone loss measured on panoramic radiographs. A team of investigators studied a group of patients after 2 years of RPD use.

These results are in accordance with Schwalm's study, reporting an increase in plaque and gingival inflammation in patients wearing removable partial dentures one to two years, connecting them with irregular hygiene instructions (18).

Knezović Zlatarić et. Al. (2) also found statistically significant higher values of PII, gingival and calculus index as well as higher tooth mobility and gingival recession on the abutment teeth in comparison to the non-abutment teeth in 205 RPD wearers ($p<0,01$) attributing it to the RPD design.

Although we did not investigate the influence of axial and para-axial loads on abutment teeth, their influence cannot be overlooked. Therefore, further studies are desirable.

Low level of oral hygiene and sophisticated metal framework design of removable partial dentures (rests, retainers, minor and major connectors) attribute to plaque accumulation around abutment as well as non-abutment teeth.

The results of this study have clearly emphasized the need for frequent recall and maintenance of patients wearing RPDs as well as better oral hygiene instructions.

Conclusions

During the 6-month period, Shei index values decreased significantly and plaque index values remained unchanged.

We concluded that the decrease in bone support on both abutment and non-abutment teeth was attributed to the high levels of PII and low level of oral hygiene. However we cannot overlook the influence of construction elements of the removable partial denture on plaque accumulation.