

Influence of Night-Time of Denture Wearing on the Rate of Alveolar Ridge Resorption in Complete Denture Wearers. A One-Year Study.

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Summary

Alveolar bone loss (RRR) is a continuous process following tooth extraction, more pronounced during the first few months after the tooth extraction than later. The RRR in the mandible is twice that of the maxilla during a 1-year period and the mandibular: maxillary resorption ratio increases further to 4:1 after 7 years. The RRR results in reduction of face height and counterclockwise rotation of the mandible. So far, the etiology of RRR has not been elucidated. It has been speculated that both systemic and local factors contribute. However, one of the local factors is daytime or daytime and night-time denture wearing. The aim of this study was to analyze the rate of RRR in five different regions of both jaws on lateral cephalograms of 100 complete denture wearers during a one-year period and to compare the rate of RRR in daytime only and daytime + night-time denture wearers. The height of residual ridges was measured on 5 different sites at the delivery of the dentures and a year later using a calibrated grid. The results revealed significant RRR in the one year period ($p < 0.01$), which was 2.5x bigger in the mandible than in the maxilla. Higher rate of RRR was recorded at frontal sites of the maxillary and mandibular residual ridges compared to lateral sites ($p < 0.01$). Night-time denture wearing made no significant influence on the rate of RRR on any of the five examined sites of the maxilla or the mandible ($p > 0.05$).

Key words: complete denture wearers, residual ridge resorption, lateral cephalograms, night-time of denture wearing.

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Introduction

Alveolar bone loss or residual ridge resorption (RRR) is a continuous process following tooth extraction (1-6, 8-24). It is more pronounced during

the first few months after the tooth extraction than later, since it slows down with time after extraction (12-17, 22-24). The RRR in the mandible is twice that of the maxilla during a 1-year period and the ratio of mandibular to maxillary resorption increas-

es further to 4:1 after 7 years (12-17). According to some authors, the RRR even stops after ten years in the maxillary jaw, while it is continuous in the mandible (16, 23). Some longitudinal studies on the RRR revealed that the mean rate of RRR was approximately about one mm/year (12-14).

The RRR is a serious and common clinical problem, especially among the elderly, because it reduces retention and stability of both the mandibular and maxillary denture. The RRR also results in a reduction of the morphologic face height and counter-clockwise rotation of the mandible (1-6, 12-24).

So far the etiology of RRR and the factors that contribute to RRR are still not completely elucidated. It has been speculated that both systemic and local factors contribute to RRR (7, 8, 12-28). Some systemic factors that contribute to RRR are: nutrition (Ca and vitamin D), hormonal imbalance, metabolic bone disease (generalised skeletal osteoporosis), some renal diseases, hormonal or drug intake, postmenopausal hormonal disbalance in women, age, sex, etc (7, 12-28). Local factors that contribute to RRR are considered: denture retention and stability, denture occlusal pressure transmitted to residual ridge or occlusal trauma, incorrect vertical or horizontal relation of the dentures, night-time wearing of dentures, occlusal scheme of the denture (balanced or without occlusal balance), the duration of denture wearing, disuse atrophy or reduced masticatory forces in denture wearers compared with age-matched dentate subjects, etc. (12-24).

Aim of the study

The aim of this study was to analyse RRR in five different regions of both jaws on the lateral cephalograms of 100 complete denture wearers and to period and to compare the rate of RRR in daytime only and daytime + night-time denture wearers.

Patients and methods

A total number of 100 eugnath completely edentulous individuals who had received new complete dentures participated in the study. They were fully informed about all the procedures and gave written

consent. The ethics committee approved this study. Two lateral cephalograms were made for each patient. The first cephalogram at the delivery of complete dentures and the second after a period of one year. Finally 50 patients completed the examination, 19 males and 31 females. Other patients were not available at the recall (second) examination.

Lateral cephalograms were made with the dentures in the mouth in the position of the centric relation (maximum intercuspation) during exposure. All the dentures were made according to the same criteria (semiadjustable articulator, no attempt of occlusal balance).

All the radiographs were made using the same equipment (Simens Roentgen Kugel 2E: 220 V, 15 mA, 70 kV) and exposure varied from 1.2 to 1.6 ms, depending on the constitution of the patient. During exposure, the head was orientated by using the cephalostat so that the Frankfort horizontal plane (tragion-orbitale) was parallel to the horizontal plane, and the mediosagittal plane was perpendicular to the horizontal plane.

The linear vertical resorption of the maxillary and mandibular process was determined as the difference in height of the alveolar process during the two stages of observation, by means of two horizontal and ten vertical planes on a calibrated grid. The horizontal line of the calibrated grid was orientated over the palatal plane (Sna-Snp). The first reference point was the intersection point of the first perpendicular line and maxillary alveolar crest ridge (U1). Successive reference points were placed at a distance of 1 cm from each other at the intersection of the perpendicular lines and alveolar process (U2-U5). Each perpendicular line of the grid had graduations of 0.2 mm (Figure 1A). To measure the resorption of the mandible, the horizontal line of the grid was orientated parallel to the mandibular line (Gn-Go) and the first reference point was the intersection of the first perpendicular line and the crest of the mandibular alveolar process (L1) and successive reference points were placed 1 cm from each other at the intersection of the perpendicular lines and the alveolar process (L2-5) (Figure 1B).

In cases with two alveolar outlines on the telerepentgenogram, the midpoint between the two lines was measured.

Patients were divided into two groups based on day-time and day+night-time of denture wearing (38 patients were wearing dentures day+night-time and 12 patients were wearing dentures only day-time). Fourteen patients had their last teeth extraction within a period of one year, 9 patients had their last extraction between one and ten years ago and 24 of the patients had extracted their last tooth in a period longer than 10 years. Statistical analysis was performed (descriptives, dependent t test, one-way ANOVA).

Results and discussion

Mean values for the height of the alveolar process at the five measured points for the maxilla (U1-5) and the mandible (L1-5) of the first and second measurement (one year later) are shown in Figure 2. The difference between the first and the second measurement was statistically significant for all five measured points in both jaws during the one year period (dependent t test, $p < 0.01$, Table 1). The reduction was highest at the first and the second point of measurement and decreased gradually towards the posterior region.

The reduction was approximately 2.5 times greater in the mandible than in the maxilla for the first point of measurement (frontal site - L1:U1) (Figure 3; $p < 0.01$, Table 2), 2 times greater in the cuspid region (L2:U2) and in the praemolar-molar region (L3:U3) (Figure 3; $p < 0.01$, Table 2), slightly greater in the molar region (L4:U4) (Figure 3; $p > 0.05$, Table 2), while in the most posterior region it was even greater in the maxilla than in the mandible (tuber-retromolar pad) (L5:U5), as the retromolar pad region in the mandible showed almost no resorption, probably due to the muscular attachments in this region.

Daytime and daytime plus night-time denture wearing had no influence ($p > 0.05$) on the rate of RRR during the first year of observation, regardless of the region in the jaw, as there was no significant difference in the rate of residual ridge resorption between these two types of denture wearers (Figure 4, $p > 0.05$, Table 3). However, it was expected that daytime denture wearers should show less RRR

compared to day+night-time denture wearers, as some authors claim that blood circulation in mucosal and alveolar bone tissue is better if the dentures are not worn during the night, and that the underlying mucosa is healthier and possible bruxing or clenching habits with the dentures are avoided if the dentures are not worn during the night.

A higher rate of RRR in the anterior regions, compared to the lateral regions could be attributed to the fact that frontal teeth are frequently the last preserved teeth before extraction and it has been proved that RRR is greater in the first few years of edentulousness than in the following years (1-6, 12-28). However, first molars are often the first extracted teeth and the time elapsed from their extraction to denture construction is sometimes more than 30 or 40 years, so the greatest amount of bone resorption might be already finished before denture construction. Most RRR in the frontal region could also be attributed to the fact that alveolar bone in lateral region is not as sensitive to resorption, particularly in the mandible, due to the muscular attachments in the retromolar pad region. If the pressure (masticatory overload) on the residual alveolar ridge was the most important factor for RRR, then the premolar-molar region should show the higher rate of RRR due to the highest stress distribution in these regions over the denture bearing area. The greatest pressure due to mastication with the dentures is supposed to be transmitted to the residual alveolar ridge under the masticatory centre, i.e. premolar-first molar region. These regions in this study showed a lower rate of RRR than frontal and canine regions (Figures 2-3, Tables 1-2). It could be that the architecture of the alveolar bone also plays a role, or time elapsed from the last extraction may be the most important factor.

It is apparent that multiple factors are responsible for RRR (29-40). Multifactorial analysis is almost impossible to perform, since more than 63 factors are considered responsible for RRR (23) and the samples of complete denture wearers participating in similar studies never exceeded fifty during the long term examination, since patients did not come for a check-up. Therefore, more study on this topic is needed until the contribution of all factors can be elucidated.

Conclusions

1. The results revealed significant RRR in a one year period ($p < 0.01$). Higher rate of RRR was recorded at frontal sites of maxillary and mandibular residual ridges compared to lateral sites.
2. The rate of RRR was 2.5x greater in the mandible than in the maxilla in frontal regions. In the most posterior region (tuberosity-retromolar pad), RRR was even greater in the maxilla.
3. Night-time denture wearing had no significant influence on the rate of RRR on any of the five examined sites of the maxilla or the mandible ($p > 0.05$).