Coll. Antropol. **27** Suppl. 2 (2003) 69–74
UDC 616.314-089.29:572.511
Original scientific paper

Influence of Body Mass Index and the Time of Edentulousness on the Residual Alveolar Ridge Resorption in Complete Denture Wearers

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A B S T R A C T

Alveolar bone loss (RRR) is a continous 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. So far, the etiology of RRR has not been elucidated. It has been speculated that both systemic and local factors contribute. The aim of this study was to analyse 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 between patients being edentulous over a different period of time and between patients with different body mass index. 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 a one year period. Body mass index had no significant influence on the rate of RRR on any of the five examined sites of the maxilla or the mandible ($p>0.05$), while the period of edentulousness had a significantly higher rate of resorption in first 3 sites of measurement (anteriorly) in patients being edentulous less than 1 year than in patients being edentulous for 1–10 years or for over 10 years (ANOVA, $p<0.05$).

Key words: *complete denture wearers, residual ridge resorption, lateral cephalograms, body mass index, period of edentulousness*

Received for publication April 28, 2003

Introduction

Residual ridge resorption (RRR) is a continous process of alveolar bone loss, which is greater during the first few months after the tooth extraction than later, since it slows down with time after extraction[1–24]. The rate of resorption is supposed to be twice more pronounced in the mandible than in the maxilla during a period which follows teeth extraction and the ratio of mandibular to maxillary resorption increases further to 4:1 after 7 years[12–17]. Some authors found out that the RRR stops after ten years in the maxillary jaw, while it is continous in the mandible[16,23]. It is supposed that the mean rate of RRR is approximately about one mm/year in the mandible[12–14].

The RRR results in a reduction of the morphological face height and counterclockwise rotation of the mandible[1–6]. However, in a patient with compromised alveolar ridges, it is almost imposible to construct new dentures which would fulfill both aesthetic and functional requirements.

RRR takes place, no matter if the dentures are worn or not. The factors that contribute to RRR are still not completely elucidated. Some systemic factors that contribute to the 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 denture retention and stability, pressure applied to residual ridge through occlusal contacts, incorrect vertical or horizontal relation of the dentures, nighttime wearing of dentures, balanced or non-balanced occlusion, duration of denture wearing, disuse, atrophy or reduced masticatory forces in denture wearers compared with age-matched dentate subjects etc. [12–24].

The aim of this study was to examine the rate of residual ridge resorption during a one-year period after the new denture delivery and to compare the rate of resorption between individuals of different body mass index and the period elapsed from the last extraction.

Patients and Methods

A total of 100 eugnath completely edentulous individuals who had received their new complete dentures participated in the study. They were fully informed about all the procedures and they gave the inwritten consent. The ethic committee approved of this study. Two lateral cephalograms were made for each patient; the first cephalogram at the delivery of complete dentures and the second after a one year period. Finally, 50 patients completed the examination, 19 males and 31 females. Other patients did not respond to the recall (second) examination.

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

All the roentgenograms were made using the same equipment (Simens Roentgen Kugel 2E: 220 V, 15 mA, 70 kV) and the exposition varied from 1.2 to 1.6 ms, dependent on the constitution of the patient. During the exposition, the head was orientated, using the cephalostat in the way that the Frankfort horizontal plane (tragion-orbitale) was parallel to the horizontal plane, and the mediosagital 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 perperndicular line and maxillary alveolar crest ridge. Successive reference points were placed at the distance of 1 cm from each other at the intersection of the perpendicular lines and alveolar process. Each perpendicular line of the grid had graduations of 0.2 mm. In order to measure the the resorption of the mandible, horizontal line of the grid was orientated parallelly 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 and successive reference points were placed 1 cm from each other at the intersection of perpendicular lines and the alveolar process (Figure 1).

In cases with two alveolar outlines on telerentgenogram, the midpoint between the two lines was measured. The difference between the first and the second measurement (one year of denture wearing) was calculated for each patient.

Patients were divided into two groups based on on the body mass index (>25 kg/m^2=1, n=44 and < 25 kg/m^2=2, n=6) and into three groups dependent on the time elapsed from the last extraction (1≤ one year, n=14; 2=1–10 years, n=9 and 3≥ 10 years, n=24).

Statistical analysis was performed (descriptive statistics, ANOVA, post hoc Sheffe).

Results and Discussion

Mean values for the reduction of the height of the alveolar process at the five measured points on the maxilla (1–5) and the mandible (1–5) dependent on the period of edentulousness is presented in Figure 2. The reduction was highest in

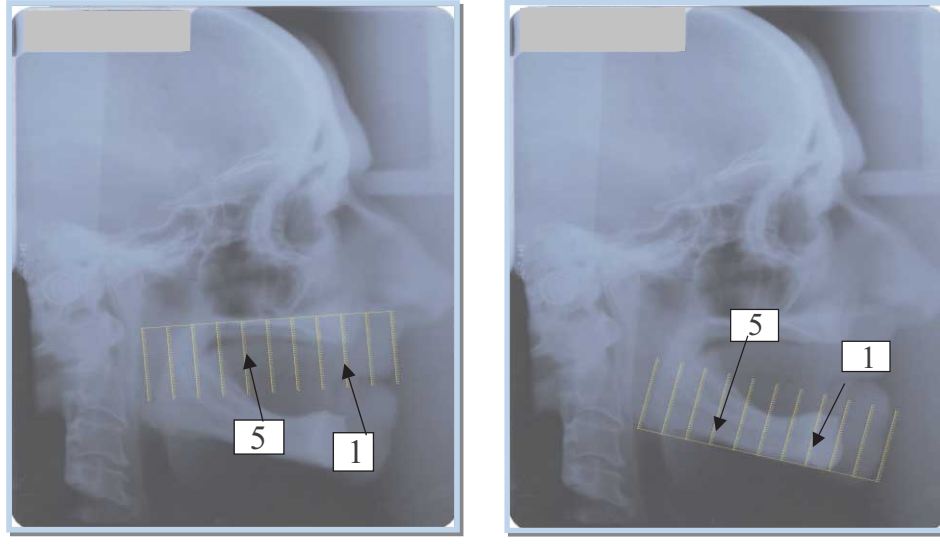

Fig. 1 A and B. Five site on the maxilla and the mandible where residual ridge resorption was measured.

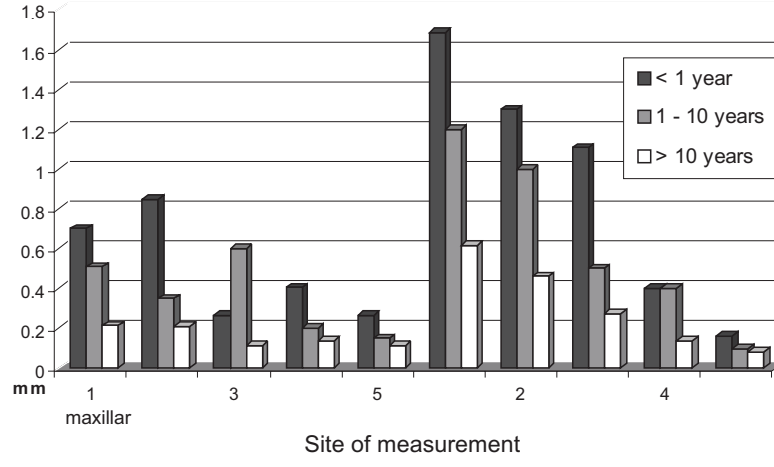

Fig. 2. Rate of resorption of maxillar residual alveolar ridges in patients with different period of being edentulous.

anterior sites of maxillary and mandibular residual ridges and gradually decreased to the posterior regions; however, the highest reduction of alveolar hight being registered in the group of patients who were edentulous for less than one year and the smallest reduction in the group of patients who were edentulous more than 10 years. ANOVA revealed significant differences between patients being edentulous less than a year, patients being edentulous for 1–10 years and those being edentulous for more than 10 years for the first three anterior sites on the maxilla and the mandible (ANOVA, $p<0.05$, Scheffe post hoc).

Mean values for the reduction of the height of the alveolar process at the five measured points on the maxilla (1–5) and the mandible (1–5) dependent on the body mass index is shown in Figure 3. The rate of RRR was slightly higher in heavy patients (body mass index >25 kg/m^2), but ANOVA revealed no significant differences in RRR between heavy and light people ($p>0.05$).

The significantly higher rate of RRR in anterior regions than in lateral regions in patients who had their last teeth extracted in a period shorter than one year could be attributed to the fact that front teeth are frequently the last preserved teeth before extraction.

Our results of the highest rate of RRR in patients who have been edentulous shorter than one year in comparison with those who have been edentulous 1–10 years or more is in agreement with other authors who found out that RRR is higher in the first year of edentulousness than in the following years[1–6,12–28].

It is reasonable to expect that overweight individuals with higher mineral bone density are less sensitive to RRR and show less RRR in comparison to normal or light people with smaller body mass index[29–31], but the fact was not proved in this study. In this study light people had less RRR than heavy people. The reason for that could be a relatively small sample, since body mass index less than 25 kg/m^2 had only six patients in this study and one of them was edentulous less than a year, while other 5 were edentulous more than 10 years. It is obvious that in the group of heavy people

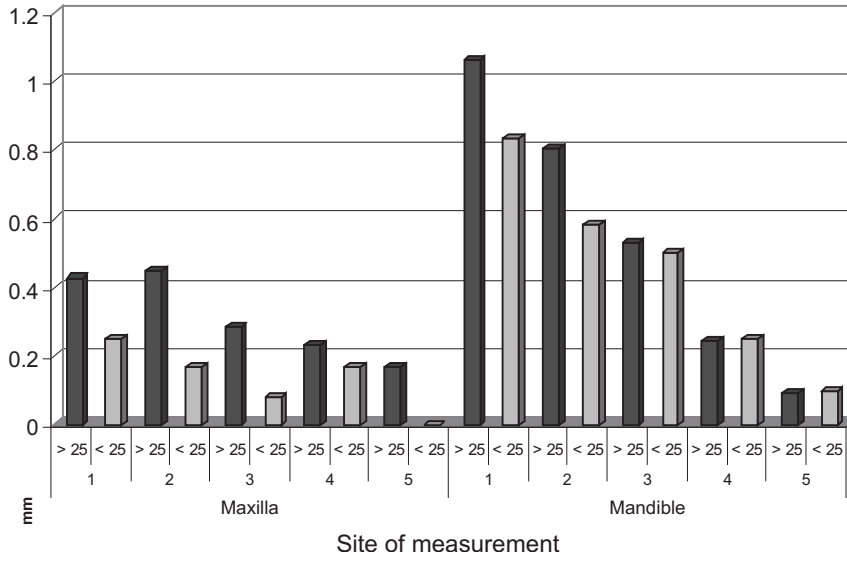

Fig. 3. Rate of resorption of residual alveolar ridges in patients with different body mass index (>25 or <25 kg/m^2).

(> 25 kg/m^2) more patients had their last extraction in a period shorter than one year and evidently this affected the rate of RRR. The results of this study lead us to conclude that the time elapsed from the last extraction is the most responsible factor for the rate of RRR.

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UTJECAJ INDEKSA MASE TIJELA I DUŽINE BEZUBOSTI NA RESORPCIJU BEZUBOG ALVEOLARNOG GREBENA U NOSILACA TOTALNIH PROTEZA

S A Ž E T A K

Resorpcija rezidualnog alveolarnog grebena (RRR) je trajni proces nakon ekstrakcije zuba, jače izražen u prvih nekoliko mjeseci nakon ekstrakcije nego u kasnijem razdoblju. RRR u mandibuli je dvostruko veća u odnosu na maksilu tijekom prve godine nakon ekstrakcije, a kasnije se i povećava do 4:1. Do sada, etiologija RRR još uvijek nije do kraja razjašnjena. Smatra se da i sistemski i lokalni faktori doprinose resorpciji. Svrha ovog rada bila je analizirati iznos RRR na pet različitih područja obje čeljusti na lateralnim telerengenogramima u 100 nosilaca potpunih proteza tijekom razdoblja od jedne godine te usporediti iznos resorpcije u pacijenata različitog indeksa mase tijela i perioda bezubosti. Visina rezidualnih grebena mjerena je na 5 mjesta u gornjoj i donjoj čeljusti prilikom predaje potpunih proteze i ponovo nakon razdoblja od jedne godine uz pomoć kalibrirane mrežice. Rezultati su pokazali postojanje statistički značajne razlike u resorpciji ovisno o vremenu bezubosti (ANOVA, $p<0.05$) dok indeks mase tijela nije značajno utjecao na iznos resorpcije (ANOVA, $p>0.05$).

Ključne riječi: potpune proteze, resorpcija rezidualnih grebena, telerengenogrami, indeks mase tijela, vrijeme bezubosti