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Discription of The Normal Mandibular Alveolar Resorption Pattern Based on Gander Using Panoramic Radiograph

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ABSTRACT

INTRODUCTION: Alveolar bone resorption occurs physiologically. The process of bone resorption and remodeling happens continually throughout our lives.**Objective**: The aim of this research is to describe the normal resorption pattern of alveolar bone based on gender in 30-60 year old people using panoramic radiograph . **Material and Method**: This research is using descriptive method. The Population is all of panoramic radiographs obtained using quota sampling technique from Padjadjaran University Dental Hospital. The sample of this study is the radiograph of 30 males and 30 female aged 30-60 year old. The radiographs measures using Ex-Paz Plus soft ware at four locations: canine, first premolar, second premolar and first molar both of side left and right jaw. **Results**: The study were found that female's resorption mean values of 1.944 and 2.073 in the 30-45 and 46-60 age range, while males were 1.813 and 1.888 respectively. Resorptions, moving from canine to the first molar, when compared between genders were: (males: 1.664, 1.737, 1.987, 2.034; females: 1.642, 1.800, 2.288, 2.304). When compared between the age groups, the resorptions from canine to the first molar were: (30-45 age range: 1.613, 1.717, 2.100, 2.083; 46-60 age range: 1.671, 1.817, 2.204, 2.229). The resorption values in region 3 and region 4 were: (males: 1.900, 1.810; females: 2.052, 1.965). **Conclusion**: bone resorption increases with age, particularly in females. Females experience more bone resorption more than males. Bone resorption tends to increases moving posteriorly, regardless of whether it was based on gender or age. Region 3 experiences more bone resorption than region 4 in both genders.

Keywords: Mandibular, Resorption, Gender, Panoramic

INTRODUCTION

Alveolar bone resorption is one of the most commonly faced dental problems by people encompassing a wide range of ages [1]. However, many studies suggest that it is more prevalent in aging adults (30-60 years). This is because alveolar bone resorption is directly affected by hormonal changes that occur during aging, marked by andropause in men, and menopause in women [2,3]. Andropause is the syndrome where the aging male experiences partial androgen deficiency characterized symptoms such as decreased sexuality, erectile dysfunction, alterations in libido. The development of this typical climacterium syndrome is believed to be at about the age of 50 [4]. On the other hand, menopause is defined as at least 12 consecutive months of amenorrhea not due to surgery or other obvious cause [5]. Internationally, the median age at which women experience natural menopause is 50 years (range, 49–52 years) [6]. Andropause and menopause has been known to cause bone loss [7,8].

In a recent research, post-menopausal women was found to consist of more than 15% of the population in developed countries and 5-8% in less developed regions of the world. By 2030, the menopausal and post-menopausal population is expected to increase to 1.2 billion, with 47 million more women added each year [3]. Life expectancy in men is also increasing, therefore making bone loss in men has also becoming more and more recognized as an important health issue [2]. With the increasing population of aging adults (30-60) and its concomitant bone resorption problem, dental health professionals would agree that the resorption pattern occurring in the alveolar bone within this population is a topic of current interest and that studying it would be beneficial to the advancement of dental health.

A study on age related changes in trabecular and cortical bone microstructure revealed that age related bone loss is a result of the interplay of genetic, hormonal and biochemical factors. The loss of quantity and quality of bone is caused by thinning of trabeculae, decrease in cortical bone, and continual resorption at the endocortical surface. These ages related processes are experienced by both males and females, but are especially prominent in postmenopausal women [9]. Bone remodeling occurs throughout life, with the achievement of maximum bone mass at the third decade of life. This is maintained in small variations until age 50, where thereafter, resorption predominates and bone mass decreases. Bone remodeling increases in premenopausal and early postmenopausal women and then slows with further aging but continues to be faster than in premenopausal women. As for men in their fifties, they do not experience the rapid loss of bone mass like women in the years following menopause. However, by 65 or 70, both men and women experience bone loss at the same rate [10].

The alveolar bone, despite being unique in location and function, is still part of the skeletal system. It is regulated metabolically along with other bones in the body, and has therefore been positively associated along with overall body bone loss [8]. There are three main co-factors influencing alveolar bone resorption. The first is the anatomical structure of the jaw such as the bone quantity, bone quality and shape. The second factor is mechanical,

in the form of the frequency and intensity, duration and trajectory of the forces applied on the alveolar bone. The third is metabolic factors consisting of age, female gender, and hormone balance such as estrogen deficiency or menopause. Menopause due to aging is the most common cause of bone loss [11].

The alveolar bone, or "The alveolar process is the part of the maxilla and the mandible that house and supports the alveoli of the teeth. It develops in conjunction with the development and eruption of the teeth, over the basal bone and coronal to it. Physiologically, the alveolar bone is the area where forces are transmitted to during mastication [12,13]. The alveolar bone quality is determined by a process called remodeling. *Bone remodeling* is the lifelong process wherein old bone is removed from the skeleton, and new bone is added [10]. This process is governed by osteoclasts, which resorb bone cells, and osteoblasts, which synthesize and mineralize the osteoid, and also produces factors that regulate osteoclast function [14].

In healthy and young people, there is a good balance between bone resorption and deposition, this prevents bone loss from occurring. However, as we age, the proliferation of osteoclasts causes resorption processes to dominate. This bone loss process begins at 35-40 years, and carries on with different intensities, with perimenopausal women experiencing more accelerated effects as compared to men [13]. This is because there are many local and systemic factors that affect bone remodeling. The local factors include post extraction conditions, bite stress, while systemic factors are hormones such as estrogen and androgens [10,15]. The normal development of bones is determined by correct functioning of the endocrine system. The hormones that play an important role in bone formation include estrogen in females, testosterone and androgen in males, and others [10].

In post-menopausal women, there is a drop of estrogen levels in the body. This drop in estrogen levels is associated with an increase in the loss of teeth and resorption of alveolar bone [8]. On the other hand, men are at peak bone mass level in their thirties. At this point men typically have more accumulated bone mass than women. However, after this point, men also experience a decline in amount of bone because of age related decrease in androgen concentration [2]. It is the loss of androgens or estrogens that increases the rate of bone remodeling and causes an imbalance by prolonging the lifespan of osteoclasts, while shortening the lifespan of osteoblasts, causing bone resorption [10].

To observe alveolar bone resorption, panoramic radiographs has been extensively utilized by researchers, because they have greater area of hard and soft tissue and the ability to visualize adjacent areas 16. It is a radiographic procedure that produces single image of facial structures including maxillary, mandibular arches and their supporting structures, utilizes intensifying screens, requires less radiation and saves time 17. Through panoramic radiographs, we can also determine the quality and quantity of the bone [18]. These factors enable the resorption pattern occurring at different locations in the jaw to be observed, therefore becoming the choice method of normal alveolar bone resorption analysis in this research.

MATERIAL AND METHOD

The methodology of this research is descriptive method [19]. The population in this study is the panoramic radiographs of all patients who come to Sekeloa Dental Hospital with the criteria: 1) Patients Men and women, 2) aged 30-60, 3) good quality radiographs especially the alveolar bone clearly visible, 4) have teeth complete in the mandible, ranging from 2 lateral incisors, molars and 4) there was no fracture of the alveolar bone. Based on this it obtained a total sample of 60 patients (30 male, 30 female). Pasient data subdivided into two age groups: Group A. 30-45 years, group B 46-60 years, both men and women. Assessment conducted on alveolar bone by measuring the height of the alveolar bone in the proximal area of the teeth on both sides of the mesial and distal.

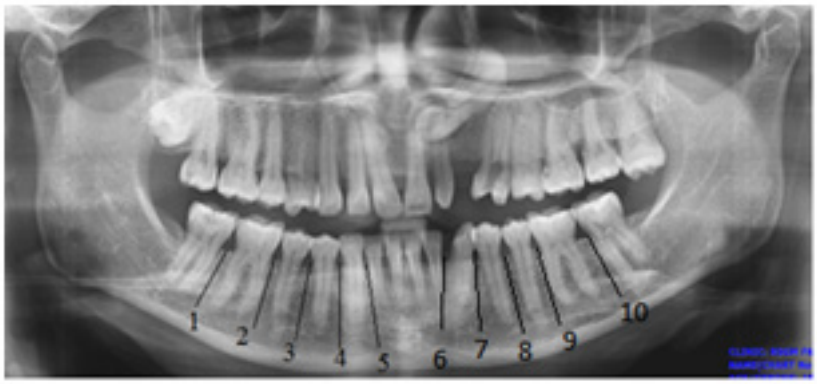

Figure 1. **Points where resorption of alveolar bone loss will be measured**

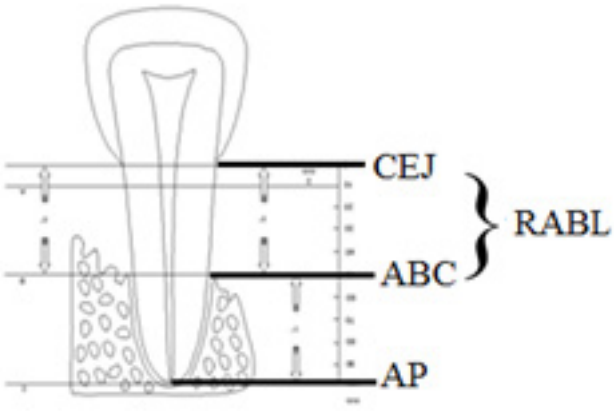

Figure 2: Anatomical location of Cementoenamel Junction (CEJ), Alveolar Bone Crest (ABC), Root Apex (AP) and Resorption of Alveolar Bone Loss (RABL)[20]

Assessment is done by resorption of Alveolar Bone Loss (Rabl) with the formula [20]:

[(CEJ–AP) − 2mm] − [ABC–AP] = RABL.

The assessment was performed on alveolar bone by measuring the height of the alveolar bone in the proximal area of the teeth on both sides of the mesial and distal. The measurement technique is illustrated as follows:

The measurement technique is illustrated as below:

RESULTS

Panoramic radiographs were assessed from 30 the males and 30 females respectively. Each gender was further divided by age into two groups- 30-45 years and 46-60 years. Each group contains 15 samples.The normal resorption pattern of the mandibular canines, premolars and first molars were measured. The results are presented in the form of mean resorption values respectively for the results of this research, canine, first premolar, second

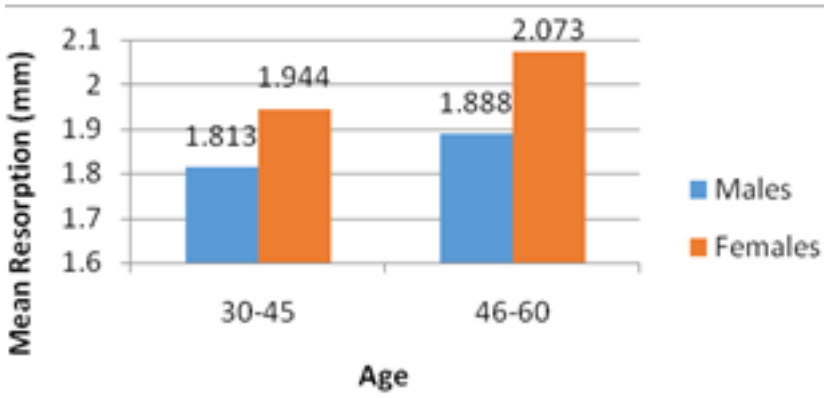

Chart1. Mean Resorption Based on Gender

Table 1. Resorption Pattern of Gender based on Location

	Mean resorption (mm)			
Gender	**C**	**P1**	**P2**	**M1**
Males	1.664	1.737	1.987	2.034
Females	1.642	1.800	2.304	2.288

Table 2. Resorption Pattern of age based on Location

	Resorption (mm)	
Gender	**Region 3**	**Region 4**
Males	1.900	1.810
Females	2.052	1.965

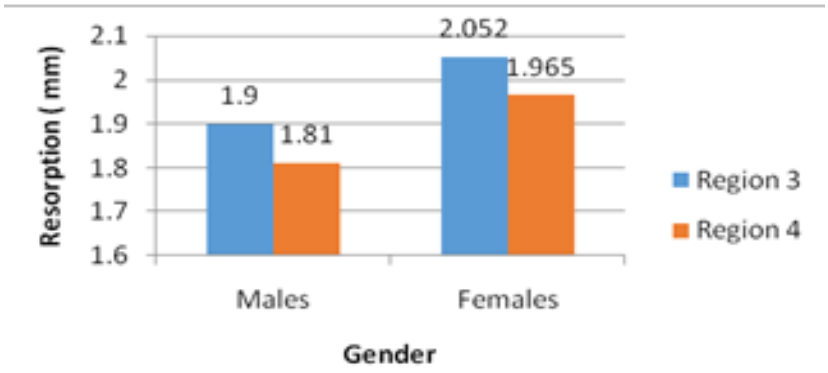

Chart 2. Resorption Pattern on Mandibular Region 3 and 4 based on Gender

premolar, and first molar. Chart 2 shows that females experience more resorption than males in both regions. However, both males and females have more resorption in region 3 than region 4 (males: 1.900, 1.810; females 2.052, 1.965).

DISCUSSION

Based on chart 1, males and females both experience bone resorption as they age [13]. This is also supported by N. Kaka et al, found that resroption progresses in direct proportion to age, due to the culmulative effetcs that affect bone resorption such as calculus and caries. After age of 30, men and women experience bone loss at about 1% yearly [1, 21]. In the 30-45 age range men and women have similar resorption numbers because hormone production for both genders is still normal. However, women still experience more resorption because of their bones are less solid than males, putting women at higher risk of bone loss [21]. This fact is supported by a statement from the Bilezikian which states that where the amount of bone at any age depends on the peak bone mass of an individual [22].

The 46-60 age range marks the onset of andropause for males and menopause for females, explaining the categorically larger resorption in women. The larger increase from resorption in age 30-45 to 46-60 in women than men also marks the time of hormonal changes of both genders [6,23]. Men are less affected by age related bone resorption because their andropause does not bring testosterone production to a complete stop, but rather just diminishes. Women however experience menopause, and there is a complete cessation of estrogen production by the ovaries, which are the main source of estrogen [24].

According to Table 2, resorption generally increases moving posteriorly because, the maximum biting force of the teeth in the molar region is greater, while anteriorly the biting force is lesser. The maximum bite force in the anterior incisor region range from 35-50 psi, in the canine region 47-100 psi and in the molar area 127 to 250 psi. In regions where bite forces are higher, bone resorption rates are also greater [25]. In women, the bite force in the second premolars appears slightly higher than the first molar. This is unexpected

because the bite force of the first molar is higher than that of the second premolar. However, the difference is not significant because the second premolar the biting forces of the second premolar are still similar to that of the first molar [26]. Also, in implant dentistry, it is generally considered that the anterior mandible consist of a denser and thicker cortical bone with course trabecular bone, while bone in the posterior mandible has thinner cortical bone with fine trabecular bone [25]. The deficit in cortical bone results in larger trabecular spaces, and thinning of the trabecular in the cancellous bone [27]. In addition to that the trabecular bone is more active in bone remodeling and this makes the posterior mandible more susceptible to bone resorption [28]. The course cancellous bone is a characteristic of a healthy skeleton, while the fine cancellous bone is associated with early fracture callus [29].

As expected, females experience more resorption in all locations except the canine region, where males have a higher resorption values. The study by N. Kaka *et al,* provides a possible explaination of this phenomenon- the bone resorption in the lower anterior teeth could be due to the thinner interseptal anterior bone and the opening of the submandibular salivary gland orifice being located lingual to the lower incisors, thus increasing plaque and calculus incidence from saliva formation. Also, most people may meet with difficulty in cleaning the lower anterior region due the curvature of the teeth. This fact could be more prevalent in males who are more careless in brushing [1].

As depicted on Table 2, shows that bone resorption increases moving from anterior to posterior mandible at age 30-45 and age 46-60. This shows that this resorption pattern of increasing resorption in posterior teeth is independent of age. The only difference between the two age groups is that the resorption values in 46-60 age group is higher. Lastly, based on chart 4.2, it can be observed that region 3, also the left mandible quadrant has more resorption in both genders because most people are right handed [27].

Right handed subjects had higher average plaque index scores in the right quadrant (region 4) compared to the lower left quadrants (region 3). This is because right handed subjects have better access to the left quadrants (region 3) of the mouth for oral hygiene procedures, thus resulting in more successful plaque removal. However, defects such as tooth abrasion were also more commonly found on the left side of the mouth (region 4) than the right side (region 4), which is associated with tooth brushing, also known as the removal of plaque mechanically. Mechanical trauma has been associated with alveolar bone loss [31,32].

This research has a couple of shortcomings. One of the few being that it was unable to be fully determined that the samples were free from systemic diseases or had factors that could affect alveolar bone height. However, each sample chosen had overall good alveolar bone health, with no obvious generalized bone resorption, so it was assumed that the samples were healthy individuals.

CONCLUSION

Based on the panoramic radiographs, it can be concluded that females experience more bone resorption more than males. Bone resorption tends to increases moving posteriorly, regardless of whether it was based on gender or age.

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