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 are 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. 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. 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. On the other hand, menopause is defined as at least 12 consecutive months of amenorrhea not due to surgery or other obvious cause. Internationally, the median age at which women experience natural menopause is 50 years (range, 49–52 years). Andropause and menopause has been known to cause bone loss.

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. 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. 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 age related processes are experienced by both males and females, but are especially prominent in postmenopausal women. 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.

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. 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). Patient 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](image)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mean resorption (mm)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
</tr>
<tr>
<td>Males</td>
<td>1.664</td>
</tr>
<tr>
<td>Females</td>
<td>1.642</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Resorption (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Region 3</td>
</tr>
<tr>
<td>Males</td>
<td>1.900</td>
</tr>
<tr>
<td>Females</td>
<td>2.052</td>
</tr>
</tbody>
</table>
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. This is also supported by N. Kaka et al, found that resorption progresses in direct proportion to age, due to the cumulative effects that affect bone resorption such as calculus and caries. After age of 30, men and women experience bone loss at about 1% yearly. 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. 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.

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. 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.

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. 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. 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. The deficit in cortical bone results in larger trabecular spaces, and thinning of the trabecular in the cancellous bone. In addition to that the trabecular bone is more active in bone remodeling and this makes the posterior mandible more susceptible to bone resorption. The course cancellous bone is a characteristic of a healthy skeleton, while the fine cancellous bone is associated with early fracture callus.

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 explanation 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.

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.

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.

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.
REFERENCES

radiography. *International Journal of Dental Research, 2*(1), 20–25.
Description of Panoramic Radiograph Failure at RSGM UNPAD

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ABSTRACT

INTRODUCTION: The panoramic radiograph is a single and a large X-ray film that shows the entire face and the bony structure of the teeth. There are few errors in performing panoramic radiographs such as positioning errors and technical errors. Objective: The purpose of this research is to identify the failure of panoramic radiograph at RSGM UNPAD. Materials and methods: The method of this research was a descriptive research with secondary data collected by a cross-sectional technique from February until March 2016. There were 418 total sample of failed panoramic radiograph taken in the Radiology Installation of RSGM UNPAD. Result: From the result, the largest proportion of the sample is from criteria 9, contact between tongue and palate, which accounts for (46.41%). This is followed by criteria 3, chin pointing upward (23.44%), criteria 10, open lips (20.81%), criteria 2, head behind of the plane focus (17.46%), criteria 7, head turned to the right (14.35%), criteria 11, incorrect position of the spine (13.39%), and criteria 6, head tilted to the leaf (11.24%). Meanwhile, there are five criteria reported the least number of sample firms, which account for less than 10 percent, namely criteria 1, head forward of the plane focus (9.33%), criteria 4, chin pointing down (8.61%), criteria 8, head turned to the left (8.37%), criteria 5, titled to the right (7.65%), and criteria 12, movement during exposure (6.93%). Conclusion: As a conclusion, the error that occurs most often is the patient does not put their tongue on the palate accounts for, while fewest error of the criteria applicable is as much as movement during exposure.

Keyword: Panoramic radiograph, Failure, RSGM UNPAD

INTRODUCTION

A panoramic radiograph is considered useful and practical to complement the clinical examination in the diagnosis of diseases of the teeth, such as endodontic disease, and disease of the bones of the face¹. One of the complementary exams more often performed
by the dentist has been the radiographic examination, which is important in the auxiliary
diagnostic in oral problems.²

The main indications of panoramic radiography are the general survey and oral
health; provide best subsidies for surgical procedures; initial and progressive evaluation
for orthodontic treatment; information on growth and development in children. Moreover,
the review about chronological dental eruptions and axes of eruptions of permanent teeth;
cystic lesions or neoplastic views; dimensional measurement for implantology; historical
documentation of the patients; evaluation of the temporomandibular joint and to detect the
existence of foreign bodies are also the indication of panoramic radiography.³

In some cases that the image quality is not satisfactory, the value of the radiographic
images decreases and they should be repeated. It will also result in increased exposure to
radiation, more cost, and waste of time (Kaviani et al., 2008) Such compromised quality is
not the result of the existing limitedness of radiographic equipment; rather, they usually result
from errors committed by the operators during patient adjustment. Therefore, knowledge
about common errors during preparation for panoramic radiographs might be effective in
preventing unnecessary exposure of the patients to radiation, wasting their time, imposing
extra costs on them, and finally resulting in high-quality images.⁴

In a study by Rushton, the most common technical errors were the patient
anteroposterior position, and low radiographic contrast and density.⁵ In another study, 35% of
the images were free of errors and in 20% of them the patients' head were in a more
anterior position than the standard. In 15.5% of the images, the patients had not placed
their tongues on the palate.⁶ In general, the least frequent error was related to patient
movement.⁷

In a study by Al-Fateh, the most common positional error was a superimposition of
the palatoglossus air space on the roots of maxillary incisors (81.8%), followed by a half
slumped position of the patients (17.2%).⁸ In a study by Glass et al., the most common
errors in panoramic radiographs of 75 edentulous patients were evaluated; in 67 radiographs
(89.3%) there were one or more errors regarding the correct positioning of the patients.⁹

In a study by S.Pandey, all radiographs taken for a 3 months period were 1010. All
panoramic radiographs examined for various errors. Data were analyzed for the frequency
of some faults, both technical and processing errors, which directly contributed to the failure
of the radiographs. Total 1010 radiographs were analyzed for errors. 27.5% (n=278) were
showing errors which ranged from technical errors 11.3% (n=14) to positional errors 16.2%
(n=164) and 72.5% of radiographs were error free. The most common technical error was
density/dark radiographs which were 45% (n=51) and the most common positional error
found was tongue not resting against the palate, 20% (n=32).⁷ A perfect X-rays cannot be
done immediately but takes time to get it.¹⁰

Concerning the importance of panoramic radiography in the field of dentistry, a study
will reveal the failure of panoramic that usually occurred in performing this radiograph for the
operator’s reference and guidance in order to minimize the errors that usually happened.
Based on the information above, the author is interested in conducting a research that
investigates the positioning errors of panoramic radiograph at the Radiology Installation of RSGM UNPAD will be conducted. The aim of this study is to identify the failure of panoramic radiograph at the Radiology Installation of RSGM UNPAD.

The purpose of this research is to determine the common factors that are affecting the failure of panoramic radiograph at the Radiology Installation of RSGM UNPAD.

MATERIALS AND METHODS

The design of this research will be descriptive study. It will be carried out by making overviews of common failures in performing panoramic radiograph at the Radiology Installation of RSGM UNPAD. The population of this would be all the panoramic radiographs at RSGM UNPAD. The samples used in this research will be the failed panoramic radiographs taken in the Radiology Installation of RSGM UNPAD that meet the positioning error criteria.

The sample size will be determined by purposive sampling technique. The total sample size calculation would be estimated from 450 samples to 500 samples.

This research would only enroll, the failed panoramic radiographs due to incorrect position that was taken at RSGM UNPAD:

- Head positioned forward the plane of focus
- Head positioned behind the plane of focus
- Chin pointing upward
- Chin pointing down
- Patient’s head tilted to the right
- Patient’s head tilted to the left
- Patient’s turned to the right
- Patient’s turned to the left
- Absence of contact between tongue and palate
- Open lips
- Incorrect positioning of the patient’s spine
- Patient movement during exposure

RESULT

Table 1 Distribution of Subject According to Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Total Radiograph</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>185</td>
<td>44.26 %</td>
</tr>
<tr>
<td>Female</td>
<td>233</td>
<td>55.74 %</td>
</tr>
</tbody>
</table>
Diagram 1 Distribution of subject according to gender

Table 2 Total Errors Based on the Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Total errors</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-19 years old</td>
<td>106</td>
<td>25.36 %</td>
</tr>
<tr>
<td>20-49 years old</td>
<td>281</td>
<td>67.22 %</td>
</tr>
<tr>
<td>50-80 years old</td>
<td>31</td>
<td>7.41 %</td>
</tr>
</tbody>
</table>

Diagram 2 Total Errors Based on the Age Group
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Total errors</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head forward of the plane focus</td>
<td>39</td>
<td>9.33 %</td>
</tr>
<tr>
<td>Head behind of the plane focus</td>
<td>73</td>
<td>17.46 %</td>
</tr>
<tr>
<td>Chin pointing upward</td>
<td>98</td>
<td>23.44 %</td>
</tr>
<tr>
<td>Chin pointing down</td>
<td>36</td>
<td>8.61 %</td>
</tr>
<tr>
<td>Head tilted to the right</td>
<td>32</td>
<td>7.65 %</td>
</tr>
<tr>
<td>Head tilted to the left</td>
<td>47</td>
<td>11.24 %</td>
</tr>
<tr>
<td>Head turned to the right</td>
<td>60</td>
<td>14.35 %</td>
</tr>
<tr>
<td>Head turned to the left</td>
<td>35</td>
<td>8.37 %</td>
</tr>
<tr>
<td>No contact between tongue and palate</td>
<td>194</td>
<td>46.41 %</td>
</tr>
<tr>
<td>Open lips</td>
<td>87</td>
<td>20.81 %</td>
</tr>
<tr>
<td>Incorrect position of spine</td>
<td>56</td>
<td>13.39 %</td>
</tr>
<tr>
<td>Movement during exposure</td>
<td>29</td>
<td>6.93 %</td>
</tr>
</tbody>
</table>

Diagram 4.3 The Result of Positioning Errors Observed in RSGM UNPAD
DISCUSSION

Table 1 and diagram 1 shows the female is the majority subject to the percentage of 55.74% with a total of 233 panoramic radiographs while male subject is 44.26% with a total of 185 radiographs. This result is aligning with a previous researcher Benjamin et al (2011) with results, 47.3% males and 52.7% females where the female subject is higher than the male subject.

It can be further seen in Table 2 and Diagram 2, the result of total errors is classified into three stages of age group. Stage one, child from the age of 1 to 19 years old, stage two, adolescence from the age 20 to 49 years old and stage three, elderly from the age 50 to 80 years old. With regards to the classification of total errors into a respective age group, the largest proportion of the total errors is from the adolescence group (20-49 years old), which accounts for 67.22% of the total errors. This is followed by child group (1-19 years old) 25.36% and elderly (50-80 years old) 7.41%. This result is not in any agreement of researchers because many of the studies excluded the child subject from their sample of the study. This is proved by the study done by Dhillon, 2012 and Al-Faleh where they excluded child as their sample of the study. In brief, these results indicate that the majority of the age group that usually makes positioning errors are from the age group of 20 to 49 years old (adolescence).

Table 3 and diagram 3 provide the descriptive statistics of the sample across 12 specified criteria of positioning errors that have been employed in this research. With regards to the identified criteria, the largest proportion of the sample is from criteria 9, contact between tongue and palate, which accounts for (46.41%). This is followed by criteria 3, chin pointing upward (23.44%), criteria 10, open lips (20.81%), criteria 2, head behind of the plane focus (17.46%), criteria 7, head turned to the right (14.35%), criteria 11, incorrect position of the spine (13.39%), and criteria 6, head tilted to the left (11.24%). Meanwhile, there are five criteria reported the least number of sample firms, which account for less than 10 percent, namely criteria 1, head forward of the plane focus (9.33%), criteria 4, chin pointing down (8.61%), criteria 8, head turned to the left (8.37%) criteria 5, tilted to the right (7.65%), and criteria 12, movement during exposure (6.93%).

The results from the survey report 39 errors (9.33%) is grouped under criteria 1, the patient’s head forward of the plane focus. This result is in agreement with results obtained in the studies done by Shakeel Khan (2015) where the result of patient’s head forward the plane of focus error percentage is 20.8% that examined 480 samples which is higher than recent study. They differ in result because a study by Shakeel Khan, 2015 examined all pretreatment digital panoramic radiographs of patients with permanent dentition, presenting to the Orthodontic Department where recent study the sample is taken from a various department. According to Choi (2012), the images in a radiograph will appear shortened and narrowed due to the front teeth located out of focus with a blurred aspect. In addition, the premolars will overlap the column on the ramus of the mandible.

Table 4.3 also indicates that 73 errors which represent 17.46% is grouped under
criteria 2, the patient’s head behind of the plane focus. This result is in agreement with results obtained in the studies done by Dhillon (2012) that the result shows 30.0% of percentage for patient’s head positioned behind the plane of focus based on 1,782 samples which is higher than recent study. The explanation to the differ in result compare to recent research is that the period of sample from the study of Dhillon is taken for 38 months while recent study is taken for 2 months. This occurs when the patient’s head positioned behind the plane of focus, the dental arches, especially the anterior teeth are located outside of focus with a blurred aspect as seen on the forward head positioned in expanding along a horizontal direction. This is supported by Passler and Vesser 2006; Langland and Langlais, 2002, who stated that the condyles can be designed to the side edges of the image receptor.\textsuperscript{13,14}

The other explanation for forward and backward position of the teeth on the notched bite block may be attributed either to a misunderstanding of the patients or even to underestimate the importance of proper positioning in performing the panoramic radiograph. In this study backward positioning (17.46%) was more prevalent than forward positioning (9.33%). This is with agreement by Dhillon et al that reported in their study that backward positioning of the patient (30%) was more prevalent than forward positioning (18.3%) \textsuperscript{15}

Meanwhile, there are 98 errors (23.44%) is grouped under criteria 3, chin pointing upward. This result is in agreement with results obtained in the studies done by Al Faleh (2002) that the result recorded for the percentage of chin pointing upward account for 11.6% that examined 500 samples which is lower than recent study. The result differs as seen that the studies done by Al Faleh is only focused on six positioning errors compared to recent studies that focus on twelve criteria of positioning errors. Under those circumstances, if the chin is elevated, the occlusal plane on the radiograph appears flattened or inverted, and it creates a distorted image of the jaw. Hence, the shadow radiopaque palate bone overlaps the roots of the maxillary teeth. Accordingly, Ezoddini Ardakani (2011) argued the chin of the patient and the occlusal plane must be positioned correctly so that distortions are avoided.\textsuperscript{16} In contrast, if the chin pointing down, the teeth are too overlapping region and the symphysis may be out of the jaw radiography. In addition, both mandibular condyles can be projected out of the upper edge of the image.\textsuperscript{16} As shown in table 4.3 the results indicate there are 36 errors is grouped under criteria 4, chin pointing down (8.61%). In another research stated that the percentage for chin pointing down is (12.5%) by Shakeel Khan (2015) based on 480 samples which is higher than recent study. The differ in the result is because of the amount of sample conducted by Shakeel Khan et al higher.

Furthermore, the results of the research pointed out that there are only 32 errors (7.65%) is fall down under criteria 5, titled to the right, while 47 errors (11.24%) fall down under criteria 6, titled to the left. In fact, Dhilllon (2012) states that it is very common for the patient to incline or turn the head to the right or left. Therefore, it is possible to observe the radiographic image in an asymmetric structure to the side to which has the slope seemed to have reduced in size compared to the opposite side and occurs marked overlapping in the proximal surfaces.\textsuperscript{17} This result is also supported in the research by Dhillon that the percentage of patient’s head tilted to left or right is 12.7% that examined 1,782 samples.
The explanation to the differ in result compare to this research is that the amount of sample from the study of Dhillon is taken for 38 months while this study is taken for 2 months with a large sample size.

In addition, criteria 7, head turned to the right and criteria 8, head turned to the left report the total error as 14.35% and 8.37%, respectively. For this reason, the film shows that the teeth on one side of the midline appear to have extended and to overlap the sharp proximal surfaces, whereas, the teeth on the opposite side are shown shortened. As a result, the branch from one side of the mandible appears much larger than the other one, and the condyles differ in size. This result is in agreement with the result obtained in the studies done by Kaviani (2008) reported that the percentage of patient head rotation to left or right occurred accounts for 39.5% based on 250 samples. They differ in a result seen in the study of Kaviani higher than recent study because the amount of sample is lower than a recent study that only emphasize in positioning error compared to the previous study by Kaviani that conducted darkroom errors, failure to remove metallic accessories, and equipment setup error.

On the other hand, Table 4.5 highlighted that 194 errors are grouped under criteria 9, no contact between tongue and palate meanwhile 87 errors is grouped under criteria 10, open lips. Under that situation, the absence of tongue contact with the palate is identified by the visualization of a radiolucent band designed at the height of the apex of the upper teeth in a panoramic radiograph. Moreover, if the tongue is not on the plate or the lips are open, the air between the parted lips obscures the crown of the upper and lower teeth. The apical region of the maxillary teeth is obscured by the dark air space between the dorsum of the tongue and the hard and soft palates (palatoglossal air spaces). This is supported by Akarslan et al., (2003) who provided that the position of the tongue also has a great influence on the quality of the radiographic image.

The possible explanation for this error may be a lack of communication between the operator and the patient because of different languages. The technician may find difficulty in instructing the patient to swallow and to keep the tongue on the roof of the mouth. Another explanation is that the patient sometimes may misunderstand the instruction, putting only the tip of the tongue on the palate, or the patient does not pay much attention to the instruction given by the operator. Finally, criteria 11, incorrect positioning of spine and 12, patient movement during exposure show a result of 56 errors and 29 errors, respectively. This result is in agreement with the result obtained in the studies done by Al Faleh (2002) research that the incorrect patient’s spine occurred accounts for 17.2% that examined 500 samples. With respect to posture of the patient, the incorrect column positioned and movement during radiography can produce a “ghost image” in radiopaque area in the center of radiography, in the region of the incisors, as well as blurred portions in radiography and large site defects in the inferior border of mandible. The explanation for the incorrect spine is there is a natural inherent tendency for patients when holding the handles of the machine to slump. The dental technician needs to make sure before taking the radiograph that, the patient’s back and spine are erect with the neck extended.
Based on table 4.3 the result shows the largest percentage is absence contact of the tongue on palate criteria account for 46.41%. This is supported by S. Pandey in 2014 that also result in the highest amount of percentage is 71.6% that examined 1010 of radiographs. The least numbers of percentages based on the research result are patient movement during exposure, which is accounted for 6.93%. This is confirmed by the study of Dhillon in 2012 that examined 1,782 radiographs of panoramic with a percentage of 1.6%.

CONCLUSION

The most frequent type of mistake in panoramic radiograph is patient positioning errors. Based on current research that has been conducted, the most common of positioning error is the patient does not put their tongue on the palate. Meanwhile the least common of positioning error is patient movement during the exposure of panoramic radiograph.

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