

Individualization through Observation of the Characteristic of Alveolar Bone of Edentulous Skulls

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Abstract: The loss of permanent teeth in an adult is highly undesirable. Usually, a tooth loss is caused by periodontal disease, trauma, and or caries. A long period of time of toothless condition will cause pathological migration of the remaining teeth and decreased alveolar bone in the edentulous region. The aim of this study is to observe the characteristics of the alveolar bones of some edentulous skulls. Observations made on the 10 skulls in The Department of Anatomy and Histology, Faculty of Medicine, Universitas Airlangga. The teeth loss antemortem could be differentiated from postmortem loss. Based on our observations on the edentulous skulls, it is found that the characteristic of the alveolar bones differed from each other based on the different rate of remodelling on the living tissue of the alveolar bone, during the life of the individuals. It can be concluded that the edentulous condition has a certain characteristic according to the length of time of the tooth loss, which can be compared to the data of the individual during life. It can help to identify an unknown individual based on the unique characteristic found on the alveolar bone of the edentulous individual.

1 INTRODUCTION

Individualization is a part of identification related to unidentified human remains. Individualization describes characters and identification of human based on the skeletal remains. Information collected from individualization would increase the number of data of a biographical profile according to skeletal remains. In other words, individualization data is supporting data in the identification process. (Koesbardiati et al., 2016).

Tooth loss (edentulous) is a condition where organism loose one or more teeth from its socket. The condition mainly happened to children aged around 6 years where the deciduous teeth are being replaced by the permanent teeth. However, tooth loss in adult age is a highly undesirable situation. Generally, edentulous happens due to periodontal disease, trauma, and dental caries (Anshary et al., 2014).

Trauma can be interpreted as dental or periodontal tissue damage due to contact with

objects that are not previously suspected on the teeth, either upper jaw (Maxilla), lower jaw (Mandible), or both. Dental trauma possibly occur directly and indirectly. Direct dental trauma happened when a hard object directly crash teeth. Indirect dental trauma, on the other hand, occurred when crash happened to the jaw, lead teeth in the lower jaw immediately crashes teeth in the upper jaw in a great force such as in accident, hit by a hard object, and in a fight (cause break in teeth or misplacement of teeth from its socket) (Siagian, 2016).

Trauma analysis and other transformation in skeleton could support individual identification related to the death cause and condition. This involves changes in physical bone characteristic. Trauma also refers to physical disturbance of living tissue due to external force. Skeletal trauma could lead to the conclusion of relative period of trauma during the death event and mechanism or the type of force causing the trauma. The period of trauma could be categorized as follows: antemortem (occurred before the death) or perimortem (happened around the time of the death). Postmortem transformation could not be considered

as trauma because based on the definition, it did not disturb the living tissue. Trauma mechanism could be categorized as a force from both blunt and sharp object, whether with thermal or high force, or could be the combination of all categories (Christensen et al., 2014).

Tooth loss is generally occurred as a result of dental caries and periodontal disease which were influenced by several factors. The percentage of tooth loss due to caries and periodontal disease depend on individual's age. In old age tooth loss was mainly caused by periodontal disease. In young age, it was caused by dental caries. Tooth loss was also influenced by smoking habit which affects periodontitis and dental caries (Anshary et al., 2014).

Neglecting the situation will cause a pathological migration of the remaining teeth and alveolar bone recession in the edentulous area (Wardhana et al., 2015).

In terms of alveolar bone, bone remodeling is simultaneously controlled by osteoclasts and osteoblasts. Osteoclasts conduct bone resorption while bone formation is induced by osteoblasts (Kim et al., 2017).

Based on this, the authors are curious in conducting research on "Individualization through Observation of the Characteristic of Alveolar Bone of Edentulous Skulls".

2 MATERIALS AND METHODS

Authors had observed Mandibula bones, collection of Department of Anatomy and Histology, Faculty of Medicine, Universitas Airlangga. The number of individuals observed were 10.



Figure 1: Fragment of the skull bone.



Figure 2: Fragment of the skull bone (from below)



Figure 3: Fragment of Mandibula bone (from above).



Figure 4: Edentulous Mandibula with alveolar

3 RESULTS AND DISCUSSION

Table 1: Edentulous alveolar bones were observed with the type of period.

Sample	Type
1 st	Antemortem
2 nd	Antemortem
3 rd	Antemortem
4 th	Antemortem
5 th	Antemortem
6 th	Antemortem
7 th	Postmortem
8 th	Postmortem
9 th	Postmortem
10 th	Postmortem

Edentulous in individuals observed in this research occurred in antemortem. According to the literature study, the situation appears on socket that has been covered (remodeling process on alveolar bone had occurred). Tooth loss could happen because of periodontal disease, trauma, and caries. This situation could provide a hint for identification by matching antemortem data that suitable with characteristic of edentulous mandibular bones, where the teeth of the individual had been lost during his/her lifetime. However, edentulous could also appear on postmortem because the socket was still uncovered. Several factors that could be considered are tooth loss before the death or missing teeth when skeletal discovered.

In such cases to fix the identity of the unknown human skeletal remains, ante-mortem medical records are to be compared in the usual practice of forensic investigations (Lodha et al., 2016).

Another antemortem transformation occurred where bone remodeling emerges as recovery form surgical procedure such as trephination and remodeling the space in alveolar when tooth loss or during the extraction process. Resorption usually takes several months after the tooth loss. When loss occurred on entire tooth with complete resorption form alveolar space, individual was considered experienced edentulous (Christensen et al., 2014).

Radiographic comparisons fall into two broad categories; dental and medical. Having annual dental examinations becoming the standard of care, the likelihood of an individual having antemortem dental radiographs is quite high. Additionally, the mineral composition of teeth makes them extremely resilient to postmortem damage, decomposition, temperature extremes, and fire destruction. Thus, both antemortem and post-mortem dental information are likely to be available for comparison (Hurst et al., 2013).

Gadro (1999) reported the essential tooth antemortem data as comparison with postmortem situation of a dead body such as dental x-rays, tooth mold, and dental record (Indriati, 2010).

Postmortem damage could be identified because the light appears from the object, thus it differs from the living bone (Burns, 2013).

In postmortem damage, outer surface of the bone has been covered with liquid decay, dirt, and different color from its inner surface. It is important to distinguish between perimortem and postmortem because perimortem involves greater amount of forensic involvement. Perimortem trauma could result from a murder act, while postmortem damage

could be caused by animal excavation or reckless excavator (Burns, 2013).

Antemortem trauma is a transformation happened before an individual's death. The main proof of an antemortem trauma is an osteogenic reaction (the creation of new bones) because the reaction happened naturally when the individual live. Osteogenic reaction mainly takes form in recovery process of response to infection. Fracture recovery could be demonstrated by the tip of a round fracture or callus formation, whereas infection response could be proven by proliferative or lytic lesions. The presence of antemortem trauma in an unidentified framework serves as information that can be useful in the identification process (Christensen et al., 2014).

Generally, tooth condition provides only limited information about antemortem of people who have died. Although dental development can be affected by systemic pathological conditions (Sucking et al., 1987), manifestation in the teeth is usually limited to make a statement that a person experiences an acute stress event during growth. On contrary, mouth disease such as dental damage, alveolar bone recession, traumatic alteration, usually did not display a helpful circumstances in developing biological profile of a dead individual (Byres, 2010).

Postmortem damage refers to bone taphonomy alteration occurred after the dead and is not related to the death event. In several cases, postmortem damage is likely related to the death events such as mutilation or situation demonstrated by murderer after a murder. Postmortem damage could be differentiated from perimortem trauma according to its color. The edge of perimortem fracture was colored by bleeding, decomposition liquid, soil, or other substance. The damaged edge of the bone tip because of postmortem will appear lighter than the surrounding area for being exposed much longer to the environment (Christensen et al., 2014).

A wide range of variables has been recognized as influence to the rate the rate of bone healing. These can be classified into intrinsic, extrinsic, and biomechanical factors and include age, fracture type, location, severity, treatment, as well as other factors (Boyd & Donna, 2018).

Bone remodeling (time period: years) is once the broken bone which is stabilized by the bony callus, osteoclasts and osteoblast take over the long-term maintenance of the rebuilt Haversian systems. The bony callus becomes smoother and denser but remains visible in spite of remodeling. (Bones of a very young child will remodel completely) (Burns, 2013).

Healing of the resulting extraction socket appeared to progress in an ordered and sequential manner. It could be a great value in forensic investigations of unidentified human remains, as it could provide some degree of accuracy to estimate the period of time that has elapsed between the antemortem extraction of a particular tooth and the time of death of that person. If the identity can be established for human remains that have a healing tooth-extraction wound or have bone changes related to the recent removal of teeth, and if the dental history of the subject is known, then this information could provide positive contributory evidence, or indeed negative evidence, toward identification of the time of death (Viciano et al., 2017).

4 CONCLUSIONS

It can be concluded that the edentulous condition has certain characteristic according to the length of time of the tooth loss compared with the data of the individual during life. It can help to identify an unknown individual based on the unique characteristic it has on the alveolar bone of the edentulous individual.

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