THE DENTAL MODIFICATIONS IN ANCIENT UNTIL PRESENT INDONESIA A CHRONOLOGICAL EVIDENCE OF INDONESIAN RACIAL IDENTITY

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Abstrak


Kata Kunci: modifikasi gigi, Indonesia, identitas rasial, Mongoloid, Australomelanesoid

Introduction

We will obtain a very broad knowledge when we always try to understand some aspects of human biology with all the practice with a look into the past. Glenner & Willey (1998) has asserted that:

“There are two ways of assessing the history of dentistry. One way is through historical documents and the other is through anatomical and archaeological specimens. Dental texts and journals provide a detailed perspective on the techniques and materials recommended, but they give only a partial story. Anatomical and archaeological specimens show that was actually being, done rather than what was dictated by texts and authorities. These specimens, however, are rare and often poorly studied” (Glenner & Willey, 1998:75).

Interesting to consider what Jacob (1964) could have expected in his research result on finding of a human mandible from Anjar urn burial site, West Java:

“….we hope that further studies of archeological mandibles found in West and Central Java, and Bali, which hitherto have never been described, and further excavations in other parts of Indonesia to be carried out with special care to preserve skeletal remains, will shed much light on the evolutionary changes affecting the mandibles and dentition as well as on the origin of the Indonesians.
and the migrational waves that occurred in western Pacific.” (Jacob, 1964: 425-426).

Here could be to associate that the archaeological and anatomical specimens, however, indicate more complexity and variety in dental modifications than period’s dental literature. Dental modifications always have a very broad perspective (Williams & White, 2006). Why is that? Maybe we can answer with a simple, because this aspect of human biology has accumulated by their behavior in a very long period. The modification of human teeth has interested researchers in archaeology, ethnography, and anthropology since the early years of this century (mower, 1999). As awareness of the practice grew, through pioneering works in Americas, researchers began to see the importance of acknowledging the emerging patterns and intriguing inconsistencies demonstrated by dental remains altered deliberately during life. Larsen (1985) has been confirmed that non-dietary function is an important concern in the study of the human dentition and its role in adaptation. In fact, Reichart et al. (2008) have reported it. The dental mutilations were and are still common among people in Africa in 33 skulls from Cameroon which have been collected around the turn of the 20th century (anthropological collection, Berlin Museum of Medical History), were dental mutilations may result in alveolar bone pathology characterized by inflammatory changes such as periapical ostitis or formation of radicular cyst. The modifications to human teeth hold anthropological and social significance, and studying them helps to understand past and present human behavior from a geographic, cultural, religious, and aesthetic perspective (Gonzales et al., 2010).

In paleoanthropological perspective, ancient humans are human populations had been living since the Late Pleistocene until several hundred years ago (Jacob, 1982, 1983). We can say as the study of ancient humans and their biological variation in the time and space. Like living people today and their ancestors hominids, they also live in and interact with its environment. They are the result of interaction between their genetics and environment. The genetics are genes that make up the genotype; and determine the characteristics, abilities, and direction of development. The human remains found in excavations and accidental findings in the field are their phenotype, which are the result of genotype and environment interactions. These phenotypes adapt to the environment in which they live. As cultural beings, they held bio-cultural adaptation; so in this case cooperation between archaeology and bioanthropology are very close (Indriati, 2001).
Culture also affects the biology, such as biology affects culture, and they exist together, both in human beings, as well as in society or prehistoric sites (Jacob, 1983).

Bioarchaeology is the study of prehistoric human behavior through the analysis of human skeletal remains from archaeological contexts (Indriati, 2001). It attempts to provide a biological perspective to archaeological examinations (Buikstra, 1997; Larsen, 1997), and central to bioarchaeological inquiry are the interaction between biology and behavior and the role of environment on health and lifestyle (Larsen, 2002). The study of human remains has generally been incorporated into biological anthropology; however, the bioarchaeological approach uses these methods and techniques to answer questions of archaeological significance (Torres-Rouff & Knudson, 2007). Using an interdisciplinary approach that incorporates methods and data from biological anthropology, archaeology, cultural anthropology, medical sciences, geography, history, and other related disciplines, bioarchaeologists analyze human adaptation and change (Buzon et al., 2005). This approach enables more accurate assessment and interpretation of osteological and dental data (Perez et al., 1997; Ubelaker, 1997; Ubelaker & Ripley, 1999; Bosch, 2000; Marcisik & Pap, 2000; Martin & Goodman, 2000; Steckel et al., 2002; Armelagos & Van Gerven, 2003; Steckel, 2005; Walker 2005; Lambert, 2006; Pechenkina & Delgado, 2006; White et al., 2006; Paine et al., 2007). Frequently fragmented and poorly preserved, such ancient skeletons require extreme care during archaeological recovery and painstaking effort during reconstruction and analysis. The very rarity that makes such specimens inordinately valuable also places limitations upon the degree to which their attributes may be said to reflect a representative pattern for an extinct population (Buikstra, 1981). A more complete picture of the past results from combining multiple data sources and helps to counter the biases and limitations in herent in skeletal data (Goodman, 1993; wood et al., 1992). It allows for a unique opportunity to understand the dynamic interaction among environment, culture, and human biology (Martin & Goodman, 2000; Indriati, 2001).

As an integrative approach, bioarchaeological analyses are particularly appropriate for an examination of individual life histories (Torres-Rouff & Knudson, 2007). Larsen (2002) convinced that skeletons represent the most direct evidence of the biology past populations and their study provides insight into health and well-being, dietary history, lifestyle (activity), violence and trauma, ancestry, and demography. Therefore,
bioarchaeology affords the opportunity to discern the individual in prehistory as well as to provide unique insights into the individual and his or her agency, a crucial element in exploring societal structures (Meskell, 2000; Pechenkina & Delgado, 2006; Temple et al., 2011).

More work that is contemporary has integrated concepts of dynamism and agency for local groups and views the process as one of reformulation. Cusick (1998) argues that acculturative models are particularly tools for undirected contact and syncretism. Acculturation studies in archaeology have generally focused on populations, however life history or osteobiographic studies can contribute to an understanding at the level of the individual (Torres-Rouff & Knudson, 2007). Lansing et al. (2007) explored linguistic and genetic variation in contact zone on the eastern Indonesian island of Sumba, where Neolithic Austronesian farming communities settled and began interacting with aboriginal foraging society’s ca. 3500 years ago. Therefore, Knudson & Stojanowski (2010) looked at the bioarchaeological discipline like this with additional optimism, which as a discipline that bridges the biological and social sciences, bioarchaeology has much to contribute to a contextualized and theoretically sophisticated understanding of social identities. Even Tung (2008) has also given hope that bioarchaeology can also help to explain migration and diaspora populations within and between regions.

Bioarchaeological researches in Southeast Asia, especially with regard to human evolution and migration, increasingly attracting the interest of scientists. Tayles & Oxenham (2006) once said something like this:

“Despite the fame, or even notoriety, of some of the earliest hominin specimens in Asia. Southeast Asia as a region has been relatively invisible in the broader sweep of world prehistory and in the centres of bioarchaeological research in Europe and North America. Beyond the Indonesia fossils, Southeast Asia and the Southwest Pacific have unique characteristics which will mean that research on the area will not only clarify about regional prehistoric peoples but also contribute to an understanding of prehistoric human biology worldwide.” (Tayles & Oxenham, 2006:2).
Domett et al., (2011) have reported the findings of intentional dental modification for the first time Cambodia in two late prehistoric sites, namely Phum Snay and Phum Sophy ca. 2500 to 1500 BP. The bioarchaeological research is relatively new for this region, and this study significantly adds to our reconstruction of past behaviors in mainland Southeast Asia. The skeletal samples combine both excavated material and large looted collections in the form of ossuaries. People from Phum Sophy and Phum Snay had similar rates of anterior maxillary dental ablation, 60 and 47%, respectively, and 21.4 and 7.7 %, respectively, in the mandible. Patterns of ablation most commonly involve the removal of the maxillary lateral incisors. Intentional filling was less common than ablation but affected Phum Snay and Phum Sophy individuals to a similar level (4-7%). Filing was also restricted to the anterior dentition, and a range of patterns were evident, many involving filing of the mesial and distal aspects of the crown of the upper and lower incisors and canines to give a pointed appearance. Patterns of ablation or filing were not strongly associated with a particular sex or age group. However, a limited number of ablation and filing patterns were exclusive to each site. They have also been discussed the significance of this practice in relation to rites of passage, status, community and family relationships, and trauma. Here shown suggesting a unique cultural behavior for this region.

This paper aims to describe the dental modifications that have been done in Indonesia based on paleoanthropological-archaeological evidences, and especially use tool of bioarchaeological approach. On the other side, this research has also investigated and showed the racial identity of the Indonesian population from Neolithic to the present times. This study may have significance for health and forensic identification. The bioarchaeological approach uses these methods and techniques to answer questions of archaeological significance. Indonesian ethnographic sources related to dental modifications are also presented.

Paleoanthropological-archaeological evidences and the sources of this ethnographic literature have attempted to bring continuity dental modifications in Indonesia. The functions of dental modifications also have attempted to be expressed, whether in relation to the initiation rites and aesthetics. We also intend to exploit that these dental modifications, which are a cultural product, related to migration and the chronology of the spread of human races from Southeast Asia to the Indonesian Archipelago and the peopling around 4000 years ago until now. We are flattered the arguments that have
been shown blench (2008) that a combination of archaeological finds, textual records and ethnographic practice make it possible to support particular historical trajectories in Southeast Asia. Some cultural practices have been associated with specific linguistic family, for example, is tattooed with the Austronesian speakers, as a means to define their cultural treasures, and, in turn, provide arguments for this diffusion practice (Bellwood, 2004). Mower (1999) further strengthen these statement that good preservation rate of teeth also provides the archaeologists with a source of information that may be the only remaining part of an interred individual, and this factor alone is a strong argument for a greater emphasis on this area of dental studies as a means of drawing conclusions regarding socio-cultural behavior in the past and approaching motivational factors in the interpretation. Mower (1999) also increasingly strengthens the efforts that this type of interpretative work is only possible with the assistance of studies conducted in related fields such as anthropology and ethnography.

We assume that human beings as biological products and processes and the environment, both a-biotic, biotic and socio-cultural environment, surely can not necessarily be viewed only as a purely biological or socio-cultural product and process. Often a single view of the phenomenon can thus potentially drown the facts in it are actually very helpful in providing a very broad and deep interpretations.

**Material and Methods**

The research materials are permanent teeth of adult skull of Java, Bali, East Nusa Tenggara, Celebes, and Papua prehistoric population from some paleoanthropological-archaeological sites. Some permanent isolation teeth of modern Balinese population are also used as a comparison, although it is not being presented explicitly. The anatomical identification is based on standardization of physical anthropology and anatomy. Sequence of its antiquity, chronology of settlement and culture, and its biologic affinity were related to Jacob (1967, 1974), Sukadana (1970, 1979, 1981, 1984), and Boedhisampoerno (1982, 1985). Environmental and cultural context can give a broader inference (Schiffer, 1976). Distinction of environment and cultural practices will result in physical distinctions that manifested on its bone and teeth (Swedlund & Wade, 1972).
The first method is visual comparative descriptive research (Swedlund & Wade, 1972; Larsen, 1985; Hilson, 1996). These selected material are observed, classified, and compared, i.e. unmodified teeth were compared with modified teeth. Then, these teeth were compared by the modification treatment patterns. At this phase, we used modified teeth of modern population that its practice still being done in Bali. Here it was needed to emphasize those paleoanthropological-archaeological materials which come from prehistoric human remains is limited in quality and in quantity, which needed special treatment in its handling, analyzing, and interpretations (Jacob, 1967, 2000; Sukadana, 1983, 1984). The second method was browsed chronologically in previous such as archaeological reports and the first ethnographic reports that reported about that reported about practices of dental modifications, particularly in Nusantara/ Indonesian ethnic groups.

Result and Discussion: Indonesian Racial Identity

Dental modifications have been done since thousand years ago in America, part of Asia especially eastern and southeastern parts, Pacific, and Africa (Uhle, 1886/1887; Lignitz, 1919/1920, 1921/1922; Faslicht, 1976; Briedenhann & Reenen, 1985; Sawyer & Allison, 1992; Hilson, 1996; Turner, 2000; Jones, 2001; Takenaka et al.; Ellis & Arubaku, 2005; Adachi et al., 2006; Coppa et al., 2006; Dewhurst & Mason, 2008; L’abbe et al., 2008; Gonzales et al., 2010), and Europe (Arcini, 2005), even in remoted island as Carribea (Handler et al., 1982), and Maldives (Fitton, 1993). Teeth have non-alimentary functions and as artifact of human behavior among some prehistoric populations (Molnar, 1972; Larsen, 1985; Miquaire, 1987; Milner & Larsen, 1991). Ninozzi et al. (2008) described as non-alimentary tooth use in prehistory at Early Holocene in Central Sahara (Uan Muhuggiaq, Tafdert Acacus, Libya). White et al. (1997) described a prehistoric Native American mandible from a Fremont site (ca. AD 1025) in Colorado has a colonial pit in the worn occlusal surface of the lower right canine. Natural causes for this modification are ruled out by the presence of internal striae, a finding confirmed by experimental replication. The canine was artificially drilled before the individual’s death and is associated with a periapical abscess. This is one of a very few examples of prehistoric dentistry in the world, and the first from the American Southwest.
Mounth means as the main social organ (Scott & Turner, 1997). With mouth, people do not only communicate but also interact through smile. Smile or laugh means to show a series of teeth that means that social organ. That is why the teeth are always being the target of modification. Modified teeth are often the series of six upper and lower teeth consist of two left and right incisive and canines. Sometimes the first premolar is also modified. This is due to the six teeth that are obviously seen when people speak or smile.

There are some reasons to people modified their teeth. Von Jhering (1882) and Scott & Turner (1997) identified dental modifications are related to aesthetic functions. Finucane et al. (2008) reported the earliest securely dated evidence for intentional dental modification in West Africa from human remains 11 individuals were recovered from the sites of Karkarichikat Nord and Karkarichikat Sud in the Lower Tlemcen Valley of Eastern Mali in Late Stone Age (ca. 4500 – 4200 BP). The dental modification involved the removal of the mesial and distal angles of the incisor, as well as the mesial angles of the canines. The modifications did not result from task-specific wear or trauma, but appear instead to have been produced for aesthetic purposes. All of the filed teeth belonged to probable females, suggesting the possibility of sex-specific cultural modification. Haour & Pearson (2005) reported prehistoric dental modification in the region comes from Kufan Karawa, Niger (ca. AD 1300 – 1600), that the modification takes the form of interproximal grooving of the maxillary incisors resulting from task-related wear. According to this topic, Romero in 1970 wrote a scale of dental filing and its variation (Scott & Turner, 1997; Hilson, 1996). Concept of beauty, which is deeply related to modification of teeth, is very varied that depends on each culture. A culture considers that teeth repeal is beautiful and pretty, maybe the other culture does filing, chipping, staining, banding, and insetting. Another group of culture considers that their white teeth are not beautiful, but the black teeth that are beautiful so that they color their teeth. The most common habit in coloring teeth use beetle-nut-chewing.

The modifications of anterior teeth for cosmetic purposes have been documented in many cultures. These practices found in Africa, America, East Asia and Pacific (Molnar, 1972; Kennedy et al., 1981; Vukovic et al., 2009). Practice of the filing of anterior teeth for cosmetic purpose is the most common in Mesoamerica. In the research to Flores cranial series (Koesbardiati & Suriyanto, 2007a, 200b), filing of the anterior teeth is found out in all individuals at the six archaeological sites. The filling teeth are the two incisors to left.
and right canines. There is also found out other filling teeth at Liang Toge (LT), Liang X (LX), and Gua Alo (GA), that is labial grinded teeth. On labial filing, the surface of the teeth is filed horizontally so that causing extensively grooved surrace. Teeth attenuation is done on upper and lower groove so that causing concavity impression on the surface of the teeth especially on the four maxillary incisors. Such labial filing is also found in Asia and Micronesia (Sangvichen, 1966; Ikehara-Quebral & Douglas, 1977) even in Europe (Arcini, 2006). At the both place, labial filling function aesthetically and for definite status.

Beside aesthetic function, modifications of teeth also function as initiation rite for male or female youths encountering mature age that also means entering marriage (Wilken, 1912; Whittaker, 1984; Fitting, 1989; Sawyer & Allison, 1992; Takenaka et al., 2001; Zumbroich, 2009), and means of status and belief (Baba & Kay, 1989; Drugan & Downer, 2005; Tayanin & Bratthall, 2006; Willis et al., 2008). Tiesler (1999) indicated installing jadeite, hematite, pyrite, turquoise and different organic substances were used as obturation material in Classic Mayan inhabitants (Guatemala, South America) as sign maturation for their member (a certain person aged 15 old years). Takenaka et al. (2001) investigated five skulls (all male, young adult-mature) out of 49 Jomon skulls. They found the presence or absence of broken roots and root fragments (right and left I1 - P1) in the alveolus resulting from ritual tooth ablation and from this it can be speculated that Jomon people used the traumatic method to knock out teeth during ritual tooth ablation. This ritual initiation is also done when a family encountering a mourning. The tradition of mourning is signed by mutilating teeth (Uhle, 1886/1887; Walken, 1912).

Tradition of dental modifications widely spreads in various tribes of Indonesia (von Jhering, 1882; Wilken, 1912). The tradition is done as a ritual in human life time that is commonly done at time preparation for marriage age. There is also evidence indicating that dental modification is also done when there is a death in a family so that the moment is also considered as tradition of mourning. This indication is also seen in Kedu, Bengkulu, Sula Island, Selayar Island, and Alfuru at Minahasa (Wilken, 1912). The inhabitants are only allowed to do tradition of dental modification if one of the closest family’s members had past away; and especially in Selayar Island, a women does the tradition of mutilating teeth (dental ablation) if her baby pass away in the same of or soon after the baby is born and in the same time of the day of the fiancé’s death. At such moment, they cut the mandibular (lower jaw) teeth. If it is done when the closest family member is still
alive, it is considered that it will cause deaths for the family members. The next patterns of modification are the common repeal that found in individual from Liang Bua (LB), Lewoleba (LL), and Melolo (ML). The Extraction teeth (dental evulsion) are the left and right lateral incisor. According to the spoken tradition, such modification had been extinct from several years ago. They extracted their teeth as sign of mourning and initiation for youths that entering marriage age, or culturally for a boy who become adult. People states that the tradition in Manggarai is that the tooth is not extracted but it is broken (ablated) to the root of the tooth and then it is filed. The same pattern is also found in Polynesia (Wilken, 1972); and in Melanesia as well as Australia (von Jhering, 1882). In the areas, broken and extracted teeth ritual is aimed as mourning ritual. Here is seen how tight the rule of tradition in this community.

Practice of dental modifications is known at prehistoric of Indonesia as a style of culture that has been followed by some regions on the level agricultural began. Some skeletons from Gilimanuk (Bali) indicate ablating at incisors, canine and first molar teeth on upper jaw and lower jaw, on skeleton R. XXVII and R. XXXII (Soejono, 1977). Such pattern of modification is also found in Minahasa (Wilken, 1912). Dental modification are also existed in findings complex of the Flores and Around. It is reported that several individuals from various paleoanthropological-archaeological sites in Flores had tradition of dental modification with various patterns (Jacob, 1967; Sukadana, 1966, 1970, 1981, 1984; van der Plas, 2007; Koebardiati & Suriyanto, 2007a). Du Bois (1944) noted, which the residents of Alor (an island opposite east of Flores) hold initiation to the youths entering marriage age. Extraction is done to both upper and lower jaw incisors. Part of this repeal, the tongue will be seen when the mouth opens, although the teeth is closed. This is related to individual attractiveness. However, Jacob (1967) states that the residents often grind their incisor teeth and fang teeth into sharp-pointed. The practice is done even opening the dentin. Sharpen-pointed is also found in Bali, i.e. findings from prehistoric Semawang (Koebardiati & Suriyanto, 2007a, 2007b). It is presumed that sharpen-pointed teeth means as certain social status or as a membership of certain group (Whittaker, 1984; Haour & Pearson, 2005; Finucane et al., 2008). The patterns of central incisors have been modified into a V-shape found at Iron Age skeletons from Pilanesberg site, South Africa (L’abbe, 2008).
Teeth-blackening (dental coloring) is a primitive method of caries prevention, and which was formerly an important life cycle event across in Southeast Asia (Flynn, 1977; Zumbroich, 2009). The life cycle event began to practiced from around puberty as a preliminary to marriage that visually marking the transition from child to adult; and offering teeth blackener to a girl could, however, also be a very direct way to indicate sexual interest. Based on archaeobotanical reports from areca nut (*Areca catechu* L.) residues those were guessed as the ingredients of betel chewing aged 13000 BP (Zumbroich, 2007/2008). The oldest teeth with stains identified in Southeast Asia belong to the skeletal remains of an approximately 4500 year old Neolithic burial in the Duyong Cave on the west coast of Palawan Island, Philippines, though neither the botanical source nor the cultural context of these colorations has been explained with any certainty (Zumbroich, 2009).

Dentitions of 31 individuals excavated from Bronze Age site of Nui Nap (Thanh Hoa province, Vietnam) were examined for the presence of *Areca catechu* (betel nut) (Oxenham *et al*., 2002). Blench (2008) confirmed that this a common practice in Vietnam (an Austroasiatic-speaking people) based on archaeological and ethnographic evidences. Many of the teeth of the Vat Komnou cemetery (date between 200 BC and AD 400 or the early historic period in the Mekong delta, Angkor Borei, Cambodia) show evidence of betel staining (Pietrusewsky & Ikehara-Quebral, 2006). The one practice which most commonly contributed to darkened teeth in Southeast Asia was chewing a betel quid, typically prepared by wrapping slivers of the seed of the areca palm (*Areca catechu* L.) with slaked lime (*calcium hydroxide*) in a betel leaf (*piper betle* L.) (Rooney, 1993; Zumbroich, 2009).

Dental coloring is also found in other areas such as Polynesia and Micronesia even in Indonesia Archipelago such as Sumatra, Nias, Borneo, Java, Madura, Bali, Flores, Timor, Papua, and other remoted islands (Senn *et al*., 2009; Zumbroich, 2009). The coloring uses chalk, *pinang* (*Areca catechu*), *gambir* (*Uncaria gambir* Roxburgh) and sirih (*Piper betle*). Papuan inhabitants made alternative several plant species i.e. *openg* (*Exocarpus latifollus*), *tawal* (*Celastraceae* sp.), *sambiwal* (*Erythroxylum ecarinatum*), *ntuo* (*Cryptocaria nitida*) and *agya* (*Endiandra Montana*) (Susuarti, 2005; Zumbroich, 2009). The mixture of *sirih pinang* with saliva generate brownish red on the teeth. To smooth all over the teeth, it is used tobacco (*Nicotiana sp.*, L.) stroked.
all over the surface of the teeth. Once chewing *sirih pinang*, the stoke of the tobacco is done twice to five times. The intensity can leave carving on the teeth. Other variant that is found in Manggarai is using certain wood to black the teeth. Tradirion of coloring teeth is existed until nowadays as honor sign for guest and part of tradition in Manggarai (Suriyanto *et al*., 2008). Tayanin & Bratthall (2006) reported that Kamumu women in Laos and Vietnam Habitually paint their teeth black with *Cratoxylum formosum* and *Croton cascarilloides* wood that purposed to be beautiful and caries-free, and it now known only among the elderly although this practice existed for many generations. Suddasthira *et al.* (2006) also reported their experiment to that habitually practiced in Thailand people, this tradition was practiced around 5000 – 4000 years ago based on archeological remains. Nguyen (1990) and Nguyen (2006) observed and reported the habit of applying black lacquer to teeth is widespread in Vietnam and its effect on incidence of dental caries and its usefulness in caries treatment. In ancient migration and peopling in Southeast Asia, Zumbroich (2009) indicated for example i.e. empyreumatic oil of coconut is attested as a blackener for Austronesia speakers in island Southeast Asia, for Mon-Khmer speakers in Vietnam and for Daic speakers in Thailand, potentially indicating the diffusion of this approach over a wide area.

Von Jhering (1882) found tens pattern of dental modifications, but Hillson (1996) only found basically 7 pattern. Uhle (1886/1887) found 17 dental modification forms that dispersed in Indonesian ethnic groups. Broadly, Lignitz (1919/1920, 1921/1922) described African ethnics practiced the tradirion, both ethnographic and physical anthropological perspective, and indicated their 25 dental modifications. Mesmerize the description by Wilken (1912) mentioned areas in Indonesia also practiced this tradition; especially areas occupied ethnics have or mixed Mongoloid elements. Clearly, von Jhering (1882) described the tradition found in Africa, Indonesian Archipelago and surroundings have mongoloid elements, and Indian ethnics in America. The oldest dental modification had been finding in Asia (Artaria, 2009). The tradition also found in Javan living population at some decades ago, and the remains are still alive at isolated villagers (Lie, 1966; Sukadana, 1966; Suriyanto & Koesbardiati, 2007c). Pinborg *et al.* (2006) reported in Central Java and on the island of Bali 779 and 437 villagers respectively, and found in Java 81.1 % of the males and 99.2% of the females showed dental mutilations in the form of grinding the incisal and vestibular surfaces of the maxillary incisors and canines; while in Bali 91.3%
for males and 96.6% for females. In Java as well as on the island of Bali most of the mutilations had been subjected to artificial staining (dental filing). They also have found a relief in Borobudur temple (built about AD 300) possibly depicting the performance of a dental mutilation. Together with the extraction, filing, and metal decorations of teeth, the process of teeth blackening was considered yet another form of dental mutilation (Romero 1970, Milner & Larsen 1991, Tayles, 1996).

Dental modifications indicated as cultural and biological affiliation (Koesbardiati & Suriyanto, 2007a, 2007b, 2007c). Milner & Larsen (19910 and White et al. (1997) called teeth as artefacts of human behavior. Von Jhering (1882) and Lignitz (1919/1920) documented amongst pre-colonial West African population as a sign of group affiliation, and Haour & Pearson (2005) was in fact thought such a reliable indicator of African culture that its identification in New World burials was argued to be the marker of recent African immigration. Here, the teeth also told to us about tale of migration and slavery (Handler, 1994; Tiesler, 2002; Wilford, 2006). Koesbardiati & Suriyanto (2007a, 2007b) is identified that there are two pattern of dental modification at Flores cranial series that presumed having different cultural background or it had been influenced by another culture. The first group is group of cultures with labial grinding teeth. The group consists of group of population from Northern Flores (Liang Toge, Liang X, Gua Alo) that have similarity of modification pattern with group of culture from Western Flores and western parts of Indonesia. For example, Balinese societies, as far as now, still hold teeth filing as part of belief and culture (Jensen & Suryani, 1996). On the other hand, pattern of dental modification with extracting is found in group of culture of Southern Flores (Liang Bua, Lewoleba, Melolo) that have similarity with culture of Adonara and Larantuka of Eastern Flores to Australia. As previously explained, culture of Alor (an island opposite east of Flores) shows pattern of teeth extracting with the same component of teeth. The comparison of dental modification on Flores’s culture with other cultures outside Flores gives information on dynamics of cultural groups of Flores.

Australomelanesoid and Mongoloid are main populations that inhabit Indonesian region. Australomelanesoid and Mongoloid inhabitantshavethedentalmodificationmethods and pattern, although exactly the first is influence mongoloidiation that more beginning in Indonesia region (Koesbardiati & Suriyanto, 2007a). Racial determination (=biological affinity) included important on Indonesian peopling history, paleoanthropology, human
genetics, archaeology and anthropology because on the present beginning racialization (ca. 15000 – 10000 years ago), gradually racial distribution changed, and there is an interconnected with many cultural aspects (Jacob, 2006a). Certainly, there are indicating that many cultural and biological aspects are unity (Indriati, 2001; Richerson & Boyd, 2005; Molleson, 2007). That is clarified by Foley & Donnelly (2001), that the disciplines need integrative recitation from many disciplines, both social-cultural and natural-exacta sciences.

Some paleoanthropological findings in Indonesia indicated that there are two racial groups: Australomelanesoid and Mongoloid. It has been recognized that at the end of Late Pleistocene, Australomelanesoid inhabited Southeast Asia and dispersed to the eastern and southern part of Indonesia (Jacob, 1967, 1974, 2006a, 2006b; White & Allen 1980). Besides that, prehistoric migrations in Southeast Asia have been the subject of much speculation by using skeletal and dental morphological traits (Jacob, 1967a, 1967b, 1974; Pietrusewsky, 1981, 1992, 1994, 2006a, 2006b, 2007; Turner, 1987; Jacob & Supriyo, 1994, 2005; Matsumura & Majid, 1999; Matsumura & Hudson, 2005; Hanihara, 2006; Matsumura, 2006; Widianto, 2006; Koesbardiati & Suriyanto, 2007; Matsumura et al., 2008), linguistic and archaeological comparisons (Blust, 1996; Bellwood, 2000, 2006; Diamond & Bellwood, 2003; Szabo & O’Connor, 2004; Adelaar, 2005; Tryon, 2006; Spriggs, 1998, 2007), human genetic comparisons (Ballinger et al., 1992; Melton et al., 1995; Skykes et al., 1995; Melton et al., 1998; Lum et al., 1998; Su et al., 2000; Capelli et al., 2001; Chow et al., 2005; Cox, 2005), ancient animal genetics and Lapita cultural complex dispersal (Lum et al., 2006), phylogeny and ancient DNA of Sus sp. (Larson et al., 2007), and language and human genetic co-evolution (Lansing et al., 2007), and even combinations of these efforts (Cavalli-Sforza et al., 1988; Nei, 1995; Oppenheimer & Richards, 2001a, 2001b; Hurles et al., 2003; Bulbeck, 2008; Peterson, 2009; Donohue & Denham, 2010; Peng et al., 2010). Other efforts have been made even against the bacteria in relation to knowing these migrations, with assumption that the pathogenic bacteria are always present in the human (population) body, and carried to where they move, and move from one place to elsewhere, and even continued to be transmitted to other populations in subsequent contacts either directly or indirectly (Moodley et al., 2009; Renfrew, 2009; Yamaoka, 2009; Koesbardiati & Murti, 2011). At the end of the Late Neolithic and Paleometallic, the polarization of the racial became more apparent. The element of
Australomelanesoid were stronger in the east and south of Indonesia. On the other hand, the elements of Mongoloid developed stronger in western and northern part of Indonesia. Based on some characteristics of paleoanthropological populations, it indicates that the Mongoloid came from the mainland Asia and pushed the Australomelanesoid to the most eastern Indonesia (Jacob, 1967, 1974, 2006a, 2006b; Sukadana, 1970, 1981, 1984; Sukadana & Wangania, 1977; Glinka, 1978, 1981, 1993, 2008; Glinka & Koesbardiati, 2007; Koesbardiati & Suriyanto, 2007c).

According to the patterns of migration in Indonesia, the assumption can be built based on these patterns of dental modifications (Koesbardiati & Suriyanto, 2007a, 2007b, 2007c). The Patterns of dental modification that was disappeared earlier are the oldest patterns that have ever been practiced in Indonesia. Other side, the youngest patterns or the newest influence are the patterns that existed in longer time and it could be practiced until now. Population dynamic, intensity of population’s interaction and isolated or unisolated population, can influence this.

Table 1 and Figure 1 show the variety of pattern of dental modifications around Neolithic to present Indonesia. There are six patterns of dental modifications, which are practiced in Indonesia. There are occlusal dental filing, labial filing, labial, and lingual filing, and sharpening (dental ablation), extracting (dental evulsions) and blackening (dental coloring). Dental filings (dental ablations) are a common trait, involving the reshaping of the anterior teeth by filing into points, or by the removal of the incisive edges, and this process can lead to exposure of the dentine, resulting in medical complications; and dental evulsions often associated with initiation rites, and dental evulsions can involve the removal of any number of deciduous or permanent teeth; and dental colorings are a practice common in Southeast Asia, usually involving blackening or other such discoloration, thought to be derived from a desire to differentiate humans from animals (Hobart et al., 1996; Whittington & Reed, 1998; Mower, 1999). The most common pattern is occlusal filing, followed by blackening, labial filing, extracting and sharpening.
Table 1. The antiquities, biological affinities and patterns of dental modification in around Neolithic to present Indonesia

<table>
<thead>
<tr>
<th>No</th>
<th>Series</th>
<th>Antiquities1</th>
<th>Biological affinities2</th>
<th>Patterns of dental modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leang Cidung</td>
<td>Mesolithic</td>
<td>Mongoloid</td>
<td>Filing (occlusal I-C), extracting (maxilla t²-C, right/left), and blackening</td>
</tr>
<tr>
<td>2</td>
<td>Leang Karasa</td>
<td>Mesolithic</td>
<td>Mongoloid</td>
<td>Filing (occlusal I-C), extracting (maxilla t²-C, right/left), and blackening</td>
</tr>
<tr>
<td>3</td>
<td>Liang Moner</td>
<td>Mesolithic</td>
<td>Australomelanesoid</td>
<td>Filing (labial and occlusal I-C, right/left)</td>
</tr>
<tr>
<td>4</td>
<td>Liang Toge</td>
<td>Mesolithic (3550±525 BP)</td>
<td>Australomelanesoid</td>
<td>Filing (labial and lingual and occlusal I-C, right/left), and blackening and sharpening (?)</td>
</tr>
<tr>
<td>5</td>
<td>Liang Bua</td>
<td>Mesolithic (3390±270 BP)</td>
<td>Australomelanesoid</td>
<td>Filing (occlusal I-C, right/left), extracting (maxilla t²-C, right/left), and blackening</td>
</tr>
<tr>
<td>6</td>
<td>Gua Alo</td>
<td>Mesolithic/ Neolithic</td>
<td>Australomelanesoid</td>
<td>Filing (labial I-C, right/left)</td>
</tr>
<tr>
<td>7</td>
<td>Liang X</td>
<td>Mesolithic/ Neolithic</td>
<td>Australomelanesoid</td>
<td>Filing (labial and occlusal I-C, right/left)</td>
</tr>
<tr>
<td>8</td>
<td>Biak</td>
<td>Mesolithic to Early Neolithic</td>
<td>Australomelanesoid</td>
<td>Filing (occlusal I-C, right/left)</td>
</tr>
<tr>
<td>9</td>
<td>Lewoleba</td>
<td>Early Neolithic (2990±160 BP)</td>
<td>Australomelanesoid</td>
<td>Filing (occlusal I-C), extracting (maxilla t²-C, right/left), and blackening</td>
</tr>
<tr>
<td>10</td>
<td>Gua Oechnik</td>
<td>Early Neolithic</td>
<td>Australomelanesoid</td>
<td>Filing (occlusal I-C), extracting (maxilla t²-C, right/left), and blackening</td>
</tr>
<tr>
<td>11</td>
<td>Melolo</td>
<td>Neolithic</td>
<td>Australomelanesoid</td>
<td>Filing (occlusal I-C), extracting (maxilla t²-C, right/left), and blackening</td>
</tr>
<tr>
<td>12</td>
<td>Puger</td>
<td>Neolithic</td>
<td>Australomelanesoid</td>
<td>Filing (labial I-C, right/left), and sharpening</td>
</tr>
<tr>
<td>13</td>
<td>Selayar</td>
<td>Neolithic</td>
<td>Mongoloid</td>
<td>Filing (occlusal I-C, right/left)</td>
</tr>
<tr>
<td>14</td>
<td>Plawangan</td>
<td>Paleo metallic</td>
<td>Mongoloid</td>
<td>Filing (labial and occlusal I-C, right/left), blackening and sharpening</td>
</tr>
<tr>
<td>15</td>
<td>Nindo Lesih</td>
<td>Paleo metallic</td>
<td>Mongoloid/ Australomelanesoid</td>
<td>Filing (labial and occlusal I-C, right/left)</td>
</tr>
<tr>
<td>16</td>
<td>Gilimanuk</td>
<td>Paleo metallic (1500 - 2000 BP)</td>
<td>Mongoloid</td>
<td>Filing (labial and lingual incisal I-C, right/left)</td>
</tr>
<tr>
<td>17</td>
<td>Semawung</td>
<td>Paleo metallic</td>
<td>Mongoloid and Australomelanesoid</td>
<td>Filing (labial and occlusal I-C, right/left), blackening and sharpening</td>
</tr>
<tr>
<td>18</td>
<td>Gunung Piring</td>
<td>Paleo metallic</td>
<td>Mongoloid</td>
<td>Filing (occlusal I-C, right/left)</td>
</tr>
<tr>
<td>19</td>
<td>Sentani</td>
<td>Paleo metallic</td>
<td>Australomelanesoid</td>
<td>Filing (occlusal I-C, right/left)</td>
</tr>
<tr>
<td>20</td>
<td>Muncar</td>
<td>Paleo metallic (1500 - 2000 BP)</td>
<td>Mongoloid</td>
<td>Sharpening (I-C, right/left)</td>
</tr>
<tr>
<td>21</td>
<td>Wonsuari</td>
<td>Neolithic to Megalithic</td>
<td>Australomelanesoid</td>
<td>Filing (occlusal I-C, right/left)</td>
</tr>
<tr>
<td>22</td>
<td>Slompretan</td>
<td>Early historical era (1000 BP)</td>
<td>Mongoloid/ Australomelanesoid</td>
<td>Filing (occlusal I-C), extracting (maxilla t²-C, right/left), and blackening</td>
</tr>
<tr>
<td>23</td>
<td>Bancar</td>
<td>Classic period (300 - 500 BP)</td>
<td>Mongoloid</td>
<td>Filing (occlusal I-C, right/left)</td>
</tr>
<tr>
<td>24</td>
<td>Kelor</td>
<td>Classic period (100 - 600 BP)</td>
<td>Australomelanesoid</td>
<td>Filing (labial and occlusal I-C, right/left), and blackening</td>
</tr>
<tr>
<td>25</td>
<td>Caruban</td>
<td>Classic-Islam period</td>
<td>Mongoloid/ Australomelanesoid</td>
<td>Extracting (I-C, right/left), and blackening</td>
</tr>
</tbody>
</table>

Sharpening is the pattern that was practiced by the populations with the antiquity from Mesolithic Age (Liang toge) until Paleometallic Age (Puger, Plawangan, Semawang, Muncar). The pattern also found in Africa at Iron Age (Haour & Pearson, 2005; Finucane et al., 2008; Labbe et al., 2008). This tradition has been practicing in Mentawai, include Siberut Island (Koerniati, 2004). Considering the result of the research conducted by Sudoyo (Adi, 2006) that the possibility of Indonesian’s gene pool was from Mentawai population, it is clear that sharpening could be assumed as one of the oldest pattern of dental mutilation in Indonesia. At that time, Australomelanesoid as the racial element in Indonesia (Jacob, 1967, 1974, 2006a, 2006b; Sukadana, 1970, 1981, 1983; Sukadana & Wangania, 1977; Glinka, 1978, 1981, 1993; Glinka & Koesbardiati, 2007) inhabited Indonesia. This tradition did not spread broadly in Indonesia, it could be caused by population isolation therefore sharpening was not continued successfully.

Extracting was pattern that could be contemporaneous with the sharpening. The pattern of extracting, especially dispersed in Sulawesi (Leang Cadang and Leang Karassa)
and East Nusa Tenggara (Liang Bua, Lewoleba and Melolo), that dispersed afterwards to Java Island (Slompretan and Caruban). Population with Australomelanesoid racial element dominated the pattern of extracting. The range of antiquity of the extracting pattern is between Mesolithic to Early Historical Age. Only some culture groups have practiced the pattern until several years ago in East Nusa Tenggara (Koesbardiati & Suriyanto, 2007a, 2007b). This tradition was also found in some population outside Indonesia (von Jhering, 1882; Uhle, 1886/1887; Lignitz, 1919/1920, 1921/1922; Kennedy et al., 1981; Handler et al., 1982; Haour & Pearson, 2005; Briedenhann & van Reenen, 1985; Sawyer & Allison, 1992; Hilson, 1996; Takenaka et al., 2001; Ellis & Arubaku, 2005; Adachi et al., 2006; William & White, 2006; Dewhurst & Mason, 2008; Finucane et al., 2008; L’abbe et al., 2008; Willis et al., 2008). This pattern still existed although there was the wave of migration came from the north that is dominated by Mongoloid, which influenced Indonesia. Nelsen et al. (2001) arguing with caution, and states an alternative explanation is that the teeth may have been lost during life through pathology or deliberate removal (ablation) based on a human skeletal sample from the Iron Age cemetery of Noen U-Loke (ca 200 BC – 500 AD) in Thailand has very high prevalence at 79% of adults with at least one incisor missing in either maxilla or mandible.

The labial (incisal) filing pattern developed along the north Coast of Flores Island until Bali Island and Java Island. In this pattern, including labial (incisal) and lingual filing (bifacial ablation), as shown in Gilimanuk’s series and liang Toge’s series. We also found this pattern on the sole Australomelanesoid individual (R. IV SMW/88), the individual is adult female based on the morphological characteristics, in Semawang’s serie. The range of the antiquity of this pattern was Mesolithic to Classic age. Based on the biological affinity, these populations were influenced by the mongoloidization (Jacob, 1967, 1974, 2006a, 2006b; Sukadana, 1970, 1981, 1984; Sukadana & Wangania, 1977; Glinka, 1978, 1981, 1993, 2008; Glinka & Koesbardiati, 2007; Koesbardiati & Suriyanto, 2007c). This pattern developed in the same period with the teeth-blackening pattern (Sangvichen, 1966; Flynn, 1977; Susiarti, 2005; Sudhasthira et al., 2006; Koesbardiati & Suriyanto, 2007a, 2007b). The teeth blackening were more common and have been practicing until now compare to the labial (incisal) filing pattern (Lie, 1966; Sukadana, 1966; Nguyen, 1990; Susiarti, 2005; Sudhasthira et al., 2006; Tayanin & Bratthall, 2006; Koesbardiati & Suriyanto, 2007a, 2007b, Suriyanto et al., 2008; Zumbroich, 2009). It is assumed that
This pattern was influenced by the change of the meaning of sirih pinang chewing. Sirih pinang chewing means healthy teeth, in the other hand, sirih pinang chewing means also ritual and magic; and nowadays, sirih pinang chewing is just like addiction, and normally just old people do this tradition (Nguyen, 1990; Susiarti, 2005; Suddhasthira et al., 2006; Tayanin & Brathall, 2006). This can be found in all part of Indonesia, for example Java, Nusa Tenggara and so on.

Occlusal filing dispersed most broadly and in longest period. Its antiquity’s range was from Mesolithic to early Historical Age. This pattern also found at prehistoric Japan (Takenaka et al., 2001; Adachi et al., 2006). This pattern has been also practicing until now although in small number, both in Indonesia (Koesbardiati & Suriyanto, 2007a, 2007b) or foreign countries, especially Africa and South America (Stewart & Groome, 1968; Handler et al., 1982; Briedenhann & van Reenen, 1985; Miqnaire, 1987; Milner & Larsen, 1991; Sawyer & Allison, 1992; Fitton, 1993; Ikehara-Quebral & Douglas, 1997; Drugan & Downer, 2005). This tradition can be found in rural area of Java and Madura (Lie, 1966; Sukadana, 1966; Pinborg et al., 2006). In Bali Island, occlusal filing was done in term of religious action (Hobart et al., 1996; Jensen & Suryani, 1996). Considering this facts, it is assumed that occlusal filing was the most recent pattern of dental modifications that have been done intensively by various culture groups in Indonesia.

The pattern of dental modifications are not absolutely representation of certain culture groups, and these pattern could be a development or variant of the local culture (Koesbardiati & Suriyanto, 2007a, 2007b; Suriyanto & Koesbardiati, 2009). The difference and the similarity of the patterns of dental modification can show the migration dynamic of the certain culture groups (Koesbardiati & Suriyanto, 2007a, 2007b). Turner (2000) actually has also been suspected about the links among forms of dental modification in the evolution of culture, although only a glimpse in the face of evidence of human remains of post-archaic Indian culture in the American Southwest. This indicates that the patterns of dental modification are the important variable that be considered to determine migration dynamic and racial history. Based on the patterns of dental modification, that can be showed that the patterns of migration in Indonesia fit with the patterns of migration based on the metric and DNA results (Jacob, 1967a, 1976b, 1974, 2006a, 2006b; Sukadana, 1970, 1981, 1984; Sukadana & Wangania, 1977; Glinka, 1978, 1981, 1993; Ballinger et al., 1992; Melton et al., 1995; Sykes et al., 1995; Melton et al., 1998; Lum et al.,
1998; Su et al., 2000; Adi, 2006; Glinka & Koesbardiati, 2007; Koesbardiati & Suriyanto, 2007c), and epigenetic results (Suriyanto et al., 2006; Suriyanto & Koesbardiati, 2006). The domination of the Australomelanesoid of the whole Indonesia was changed by the Mongoloid that came commonly from the west and afterwards from the north of Indonesia (Jacob, 1974; Glinka, 1978, 1981, 1993, 2008; Suriyanto et al., 2006; Suriyanto & Koesbardiati, 2006; Glinka & Koesbardiati, 2007; Koesbardiati & Suriyanto, 2007c).

The result has provided the views that can enrich the hypotheses relating to the dental modifications that have been developed previously. Temple et al. (2011) have done a recent research are still supporting a hypothesis that the identities associated with tooth ablation were unrelated to migratory patterns, and instead, possibly reflect kin-based social units, where achievement or age acted as determinants of membership. This study has documented and interpreted patterns of identity in relation to dental ablation patterns at Yoshigo (Japan), a Late/Final Jomon period (3500-2500 years BP) site. Differences of these researches can be understood that the temple et al.’s research is only based on findings from one site, and just focus on one pattern of dental modification, namely dental ablation. Just to remind, that in addition to dental ablation, the basic pattern can still be found, namely dental evulsion, staining/ coloring/ blackening, and inlay. And just for additional information, that the use teeth as a tool to help some of the activities of everyday life can also be incorporated into dental modification (Water-Rist, 2010).

The use of teeth as tools provides clues to past subsistence patterns and cultural practices. Waters-Rist et al. (2010) have found the evidences of excavation work in Siberia. Five Holocene period hunter-fisher-gatherer mortuary sites from the southwestern region of Lake Baikal, Siberia, Russian Federation are observed for activity-induced dental modification to further characterize their adaptive regimes. Grooves on the occlusal of teeth are observed in 25 out of 123 individuals (20.3%) and were most likely produced during the processing of fibers from plants and animals, for making items such as nets and cordage. Regional variation in the frequency of individuals with occlusal grooves is found in riverine versus lakeshore sites. This variation suggests that production of material culture items differed, perhaps in relation to different fishing practices. There is also variation in the distribution of grooves by sex: grooves are found predominately in females, except at the Late Neolithic—Bronze Age river site of Ust’-Ida I where grooves are found exclusively in males. Occlusal grooves were cast using polyvinylsiloxane.
and maxillary canine impressions were examined by scanning electron microscopy to determine striation patterns. Variation in striae orientation suggests that a variety of activities, and/or different manufacturing techniques, were involved in groove production. Overall, the variability in occlusal groove frequency, sex and regional distribution, and microscopic striae patterns, points to the multiplicity of activities and ways in which people used their mouths and teeth in cultural activities.

The dental modifications in the ancient Indonesia, which has multiple functions (initiation rite, aesthetics, etc.), once clarify the migration history of Indonesian population from Southeast Asia in prehistoric times. The Homo sapiens sapiens, which consisted of sub-species Mongoloid and Australomelanesoid, which is the large majority of the population hitherto Indonesia. The polytypic and polymorphic populations combined according to this time and space to pass their hybridization oon Indonesian population complex, and this process will continue. Indonesian racial identity is a product of the process, especially in the ancient Indonesia.

Conclusion

We described the dental modifications that have been done in Indonesia based on paleoanthropological-archaeological evidences, either in the form of isolated teeth and along the mandible and maxilla, and the skull. Indonesian ethnographic sources related to dental modifications were also presented. Paleoanthropological-archaeological evidences and the sources of ethnographic literature have attempted to bring continuity the dental modifications in Indonesia. The functions of dental modifications also have attempted to be expressed, whether in relation to the initiation rites and aesthetics. The researchers also intend to exploit that these dental modifications, which were a cultural product, related to migration and the chronology of the dispersion of human races from Southeast Asia to the Indonesian Archipelago and the peopling from 4000 years ago until now. The human races were Australomelanesoid and Mongoloid that is the main populations that inhabit this region. Based on the patterns of dental modification, that can be showed that the patterns of migration in Indonesia fit with the patterns of migration based on metrical, epigenetic, and DNA results. The domination of the Australomelanesoid of the whole Indonesia was changed by the Mongoloid that came commonly from the west and afterwards from the north of Indonesia.
Evidence of prehistoric dental modifications, either as a rite of initiation or aesthetics, can explain the history of racial identity of ancient Indonesian population. These efforts can be done because we assert that human biology affects culture and vice versa. Moreover, this culture, the dental modifications, was revealing traces as population migrations from the Southeast Asia to the Indonesian Archipelago. We hope that this research can synergize with particularly archaeological researches, and can synergize with each other research other aspects of human biology.

**DAFTAR PUSTAKA**


