Prevalence Profile of Oral Disease in Ancient Population

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Abstract: Oral disease has a close relationship with the subsistence patterns and attracts great attention in the paleopathological research all over the world. This review provides an overview of the general situation of the oral disease during the different historical era trying to mouse out the pathogeny and the rule of course of such diseases.

Keywords: Ancient population, caries, periodontal disease, dental attrition.

INTRODUCTION

It has been a long history since human beings evolve from ape to man. Human's oral diseases develop along with the evolution of human's cranio-maxillofacial and teeth forms as well. The dental system is a valuable source of information to understand the quality of life of ancient peoples in a particular historic and geographical frame. This paper makes a brief introduction for the common oral diseases including dental caries, periodontal disease and tooth attrition from ancient human skulls which belong to different historic era and different region. The aim is designed to understand the general prevalence of oral disease of ancient human, to make clear the pathogeny, and to master the law of development. Furthermore, it will guide us to prevent and cure modern human's oral disease appropriately.

DENTAL CARIES

Firstly, the concept of prevalence, incidence and DMFT are defined as follow:

1 Prevalence is the total number of cases of a given disease in a specified population at a designated time.

2 Incidence is the number of new cases in the population at a given time.

3 DMFT= decayed, missing and filled teeth / The number of subjects.

It is recorded that caries was detected in the skull of ancient man ape more than 800,000 years ago. Dental caries was discovered in the ancient human skull of European Neolithic Age and in ancient Egypt [1]. Grine and colleagues [2] reported cervical and proximal dental caries were identified on the hominid tooth of 1.8~1.5 million years ago. Recently, dental caries was found in the skull of caveman (about 100,000 years ago) [3]. Paleoanthropologists[4] only found 1 carious tooth on 55 skull jaw bones of Palaeolithic Age which were excavated in Pakistan. As to the Neolithic Age (about 10,000~4,000 years ago), archeologists could find more and more dental caries on the excavated human teeth.

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Around the world, the reported incidence of caries was quite different. The caries prevalence rate in Neolithic Age excavated in U.K. was 2.9% [1]. According to Moore's report [4], the caries prevalence rate in hunting age (8,000~7,000 years B.C.) was 1.3%, and the caries prevalence rate in mixed economy age (4,000~3,000 years B.C.), was 4.84%. Claassen [5] reported that the caries prevalence rate in the early stage of Iron Age (3,000~2,000 years ago) was 2.2%~5.4%. Hardwick [3] indicated that the prevalence of caries was no more than 2%~4% in Iron Age with extensive regional differences. Neiburger[6] reported that the caries prevalence rate of Southwest Asian people about 2,000 years B.C. was 2%. According to reports from Zhu [7], the dental caries prevalence rate was 93.75% in 16 specimens of Neolithic Age (about 9,000~7,500 years ago) excavated in Zeng, Guilin of Guangxi. According to reports from Zhou [8], the dental caries prevalence rate was 46.7% of 15 individualities belonging to late Neolithic Age excavated in Guangwu, Chenggao of Henan Province and the decayed teeth rate was 19.5%. The dental caries prevalence rate of people in these two places was higher than that of the other people in the same age. Li and co-workers [9] reported that, the prevalence of decayed teeth in 161 individualities in Neolithic Age (about 5,000~4,000 years ago), that were excavated in Xiawanggang, Xichuan of Henan Province was 5.3%. They claimed that the prevalence of decayed teeth were not associated with gender, age or geographical differences. Sakashita and colleagues [10] observed and analyzed the skulls of 71 citizens and slaves in Chinese Yin and Shang periods (about 4,000~3,000 years ago), and the result showed that the prevalence of caries in the periods was lower than 2.9%~4.0%.

Increase in the number of caries is related to the improvement of social productivity, the development of agriculture and food processing industry. According to the survey of Zhang [11], the caries prevalence rate of the people excavated in the graveyard which belongs to Sanyan Culture (about 1,700~1,600 years ago) of Lama Cave, Beipiao city of Liaoning province was 53.00%, and the decayed teeth rate was 7.24%. This result had distinct differences with the decayed teeth rate (4.25%) [12] of Yin period group of Anyang and the caries prevalence rate (5.33%)[9] of Xia Wanggang's group in Neolithic Age(p<0.05). The excavated remains

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showed that, except for hunting and pasturing, there had been large-scale ceramics and planting. The improvement of material life may lead to the increase of caries prevalence rate. Gagne [13] made a research on the relationship between caries prevalence rate and the development of refined sugar industry of prehistorical agricultural population of North America, and the result showed that food in rich carbohydrate and the introduction of new food processing method led to the increase of attack rate of dental caries. Meanwhile, it showed that the dental caries became more serious along with the improvement of productivity and increase of sugar intake amount.

Sakashita [10] reported that caries was most prevalent in the mesio- and disto-cervical part of the tooth, while least prevalent in occlusal pits. As to the population of Lama Cave, the proximal caries were the most and the occlusal surface caries were the next. The three molar teeth took up the highest rate in the attack rate of dental caries. And the attack rate of second molar was higher than that of the first and third molar. No distinct difference was identified between attack rate and gender. The proximal caries accounted for the largest proportion of dental caries in ancient people, but in contrast, that is the occlusal pit caries in modern people. The difference resulted from the poor production tools and coarse food in ancient time. Teeth attrition in ancient people was so serious that the possibility of the food wedging into the interproximal areas increased. Moreover, the food impaction resulted in the bacteria accumulation and occultation. It was hard to make tooth self-cleaning, so the proximal caries incidence increased greatly. Based on the dental caries prevalence situation of ancient people, it concluded that the general trend of caries prevalence rate was increasing continuously along with the development of human material civilization. And for occurrence and development of dental caries, the influence from objective factors (like social environment etc.) was greater than that from hereditary factors (like human evolvement etc.). Therefore, the study on the frequency and distribution of dental caries in ancient populations is beneficial to understanding their economic, social, and cultural progress through different historic era.

PERIODONTITIS

Periodontitis is a common and frequently-encountered disease around the world. From the ancient times to the present, people of all regions and races are suffered from it. On the excavated ancient people's jaw bones and teeth, archeologists found that the periodontitis was more serious that dental caries [2]. Trinkaus and co-workers [14] detected that the labial calculus on the human tooth specimens of late middle Pleistocene century (about 1,000,000~200,000 years ago). Periodontitis was one of the most common diseases in ancient Egypt mummies of about 5,000~4,000 years ago [15]. Inagaki and co-workers [16] studied 4 jaw bone specimens which were found in Nagoya area belonging to the Japanese Neolithic Age of about 3000 B.C. He found horizontal alveolar bone resorption, especially in the anterior regions. Neiburger [6] reported that the periodontitis attack rate was 42% of ancient southwest Asians (about 2000 B.C.). Littleton and colleagues [17] made group study on the tooth specimens of Arabian Gulf people of 3000 B.C. ~1500 A.D. and found a lot of dental calculus in the specimens. As well, the periodontitis became more and more serious along with age. Moreover, they found the situation that the serious carious lesion and tooth attrition caused the periodontal abscess sclerotin deficiency. Kerr [18] also reported that the gingivitis and periodontitis were discovered in the 504 human skulls tooth specimens of U.K. (belongs to the time from prehistoric period to about 3,000 years ago). In early human specimens, Clarke [19] reported the periodontitis caused by dental pulp. Mucic[20] analyzed 535 human skulls and 98 jaw bone specimens of past 2,000 years of Yugoslavia and found that all specimens being studies had periodontitis.

From the human skulls which belong to Neolithic Age and were excavated in Baoji of Shaanxi Province, Chinese scholars found that there were various degrees of alveolar bone damages, and the patients suffered from periodontitis accounted for 42.3% of the total number, the teeth suffered from periodontitis accounted for 11.4% [2] of the total teeth being studied. Li [9] indicated that in the specimens excavated in the historical sites of Neolithic Age in Xiawanggang, the teeth suffered from periodontitis accounted for 10.7% of the observed total teeth. The incidence in mandible was 9.7% and that in maxilla was 1.6%. The prevalence rate of periodontitis had no relation with the places of occurrence and gender, but it was strongly linked to age. Zhou [8] reported that among the specimens of Neolithic Age and excavated in Guangwu Town, Chenggao of Henan Province, the prevalence rate of periodontitis was 66.7%. Mao and co-workers [12] claimed that the prevalence rate of periodontitis of Yin dynasty excavated in Anyang area of Henan province was 18.7%. The prevalence rate of periodontitis in Yin and Shang periods was 18.3%~26.9% [10]. Scholars analyzed that the severity of periodontitis of skulls of Yin dynasty may be related with the life situation of that time. The slaves lived a hard life. Malnutrition may be the main reason for periodontitis. Zhang [11] surveyed the jaw bones excavated in the graveyard of Lama Cave and found that the prevalence rate of periodontitis was 43.11%. The teeth suffered from periodontitis account for 7.64% of total teeth being studied. The gender difference was distinct in prevalence rate of periodontitis. And the prevalence rate was closely interrelated with age. The above research showed that the condition of periodontitis deteriorated with age. Moreover, the gender difference remains to be clarified.

As the dental caries, periodontitis is the product of material civilization society. In the reports of the documents about periodontitis prevalence, the common rule is that the prevalence rate and severity is higher in the areas with backward economy and culture than that of the developed areas.

TOOTH ATTRITION

Tooth attrition includes occlusal surface attrition and proximal attrition. According to the literature review, the degrees of these two kinds of attritions of ancient people were more severe than that of modern people. Most severely attrited teeth were suffered from periodontitis at the same time. Due to the excessive tooth attrition, the pulp cavity was exposed, finally leading to periapical periodontitis.

Bermudez and co-workers [21] detected the attrition groove on the teeth proximal surface of Spanish in the middle Pleistocene century. They presumed that the people of

that era used fibrous matter as "toothpick", or the teeth grinded coarse fare for a long time so that the special teeth attrition pattern occurred. Borrman and colleagues [22] researched the ancient human skulls of about 50,000 years ago and found extensive teeth attrition in the occlusal surface. Besides, in some severe attrited teeth, the dental pulp was exposed and even had periapical periodontitis. The scholars concluded the reasons as following: The excessive attritions made the periodontal tissue lose balance and caused traumatism occluding relation. Moreover, as a result of severe attrition, the bacteria passed through the dental crown, invaded into pulp cavity, and caused pathological change of periapical tissue. Inagaki [16] found extensive teeth occlusal surface attrition in the 4 jaw bones specimens of Japanese in Neolithic Age of about 3000 years B.C., and the teeth presented flat plane shape. It was analyzed that grinding hard food and using teeth as tools may be the reasons for severe teeth attrition. Meanwhile, Littleton [17] reported the situation that severe teeth attrition led to periodontal abscess and further alveolar bone deficiency in the ancient people specimens of Arabian Gulf of 3,000 B.C. ~1,500 A.D.. After comparing the teeth attrition situation of people in early and late Middle Ages (1,500~1,100 A.D.) with that of people in 17~18 centuries, Maat [23] proposed that the coarseness of food was an important reason for teeth attrition. Li and co-workers [9] studied the teeth of 161 specimens excavated in the Neolithic Age sites of Xiawanggang, and they reported that 17.6% of the teeth had various teeth occlusal surface attrition. Wherein, the attrition with the feature of "occlusal surface enamel disappeared completely and the dentin was exposed largely" made up the largest percentage. Zhou [8] reported that, in the 15 specimens of Neolithic Age excavated in Guangwu Town, Chenggao of Henan province, the attrition which had the same feature also accounted for the vast majority.

The teeth attrition is closely related with the coarseness degree of food, and it could become more and more severe with age. In anthropology, scholars often judge people's dietary structure and chewing habit at that time according to the teeth attrition degree. Thereby, the social production and life situation could be reflected indirectly. At the same time, scholars also use the teeth attrition to estimate the age [24]. In addition, through comparing the attrition of mandible teeth and buccolingual inclination between ancient and modern Japanese, Kasai and colleagues [25] proposed that the lower molars trend to buccal side under the situation that masticatory force was relatively great and teeth attrition is severe.

It suggested that due to considerable occlusal surface attrition and proximal attrition, the teeth of ancient people continuously moved mesially, which avoided the delayed eruption or impaction of the third molar. Along with the development of social productivity, the food is finely processed, human's organ of mastication degenerates. However, the teeth of modern people obviously lack attrition. So Neiburger [26] proposed that the insufficient attrition of modern people would result in the increase of dental caries prevalence, sharp dental cusp, dentognathic deformity, periodontitis, and temporomandibular joint (TMJ) disorder. Moderately imitating ancient people's teeth attrition style would help us to reduce the prevalence of above diseases.

SUMMARY

The oral diseases develop along with the evolution of human. Although many factors from bacterial flora to host defense, are involved in susceptibility to caries, caries prevalence is more affected by cultural factors such as dietary habits, nutrients and food production techniques. The prevalence state of periodontitis has a more extensive extent than dental caries in the ancient population. However, along with the improvement of social civilization, the prevalence rate of periodontitis would have the downward trend gradually. Most teeth in the ancient people were worn flat, probably owing to the hard food and to their use as a tool, which aggravated the incidence and development of periodontitis and dental caries. Hence, the study on the frequency and distribution of dental caries, periodontitis and dental attrition in ancient populations benefits us a lot to understand the relationship between the body constitution and disease of ancient people and social-natural environment. To some certain extent, the prevalence profile of oral disease mirrors the changes of mankind living environment and the development of social culture.

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