The Diversity of Dental Patterns in the Orthopantomography and the Significance in Human Identification

Sang-Seob Lee,[1,4] D.D.S.; Jong-Hoon Choi,[1,2,4] Ph.D.; Chang-Lyuk Yoon,[3,4] Ph.D.; Chong-Youl Kim,[1,2,4] Ph.D. and Kyoung-Jin Shin,[2,4] Ph.D.

[1] Department of Oral Diagnosis and Oral Medicine, College of Dentistry, Yonsei University, Seoul, Korea, [2] Department of Forensic Medicine, College of Medicine, Yonsei University, Seoul, Korea,

[3] Department of Oral Medicine and Forensic Odontology, College of Dentistry, Chosun University, Gwangju, Korea, [4] Human Identification Research Institute, Yonsei University, Seoul, Korea.

Abstract

The primary aim of this study was to evaluate the utility of orthopantomography for human identification. Three hundred orthopantomograms were randomly selected from those stored at Dental Hospital of Yonsei University in Seoul. Dental patterns observed in orthopantomogram were converted into eight codes and their diversity was calculated. The diversity of dental patterns in orthopantomogram was 99.92% for full dentition and the diversity of mandible (99.28%) was slightly higher value than that of maxilla (98.22%). In the case of molars and premolars in both jaws, the diversity values ranged from 92.13% to 96.04%. It was founded that the orthopantomography is a valuable means of personal identification not only based on full dentition but also when only the posterior teeth are available. The present study indicates that orthopantomography is excellent means of forensic identification.

Introduction

Investigations of jaws and teeth, the most well preserved parts of the human body, have been proven a basic and valuable method in human identification. The comparison of antemortem and postmortem dental characteristics is a commonly applied method to perform personal identification. Dental radiographs are certainly one of the most desirable pieces of antemortem evidence because of their highly objective nature as compared with other records.

Of the many kinds of dental radiography, orthopantomography is a broadly applied standard method in dentistry and is used for initial examinations for odontologic issues in treatment. It provides a complete view of the teeth and both jaws in one image. Some case reports of dental comparisons involving orthopantomograms have been reported.

Adams reported upon the diversity of adult dental patterns using empirical observations of large reference data sets and showed the very diversity. These reports were specifically related to non-radiographic dental comparison and the diversity was analyzed based on them. Compared to dental charts, which may be subjective, dental radiographs are more objective and show relatively less errors. In addition, since postmortem investigators can evaluate antemortem and postmortem radiographs simultaneously, positive identification can be obtained more easily than that of dental charts which carry the risk of errors among the different investigators. For these reasons there is a clear need for the diversity of dental patterns in orthopantomograms to be explored in more detail.

Materials and Methods

The 300 orthopantomograms were randomly selected from those stored at Dental Hospital of Yonsei University in Seoul. Dental patterns were classified into eight types which are commonly observed in dental radiography and converted into a consistent set of codes by a well-trained forensic odontologist . Only permanent dentition was considered. The diversity of dental patterns was calculated for full dentition, maxilla, mandible and the sextants, respectively.

- Classified dental patterns and codes in orthopantomograms

Code	Description
V (Virgin tooth)	No evidence of dental disease, treatment or anatomical abnormality
X (Missing tooth)	Extracted or congenital missing tooth
I (Impacted tooth)	Unerupted or impacted tooth
D (Defect)	Defect by dental caries, tooth fracture or fallen out fillings
R (Residual root)	Remained root due to severe dental caries
T (Root canal treatment)	Root canal filled tooth by endodontic treatment
F (Filling)	Filled tooth
P (Prosthesis)	Tooth with crowns

Results

- The number of dental patterns for full dentition and for sextants (n=300)

Area	Number of different dental patterns	Number of unique dental patterns*
Full dentition	282	274
Maxilla	210	192
Mandible	211	181
Upper right	103	78
Upper anterior	73	65
Upper left	95	66
Lower left	85	64
Lower anterior	28	25
Lower right	106	74

* Unique dental pattern was defined as the dental pattern only once observed in this study.

- The most commonly observed dental patterns in orthopantograms (n=300)

Area	Dental pattern	Number	Percent
Full dentition	IVVVVVVVVVVVVVVI IVVVVVVVVVVVVVVI	6	2.0
Maxilla	XVVVVVVVVVVVVVVX	33	11.0
Mandible	IVVVVVVVVVVVVVVI	15	5.0
Upper right	XVVVV	66	22.0
Upper anterior	VVVVVV	219	73.0
Upper left	VVVVX	72	24.0
Lower left	XVVVV	33	11.0
Lower anterior	VVVVVV	270	90.0
Lower right	VVVVV	30	10.0

- Diversity of dental patterns in orthopantomograms

Area	Diversity (%)
Full dentition	99.92
Maxilla	98.22
Mandible	99.28
Upper right	92.43
Upper anterior	46.75
Upper left	92.13
Lower left	95.65
Lower anterior	19.02
Lower right	96.04

Discussion

These high diversity values imply the sufficient power of personal identification not only based on full dentition but also when only molars and premolars are available. The diversity of the anterior tooth area had lower value compared to full dentition or for molars and premolars. Reasons for this may be lack of complex anatomical features in anterior teeth and the self-cleansing effect of saliva. Therefore, human identification based on incisors and canines may rely on malocclusion and/or developmental anomalies rather than using dental radiographs alone.

Compared to radiographic images, dental charts may carry the risk of errors from subjective recordings of dentists. On the other hand, antemortem and postmortem radiographic images can be compared simultaneously by one investigator, and orthopantomography allows information to be transferred in a form not subject to linguistic barriers. In this context, our research based on relatively objective material, dental patterns in the orthopantomography would be considered to be valuable.

Conclusion

Dental patterns of three hundred randomly selected orthopantomograms were converted into eight codes and their diversity was calculated. The results were summarized as followings.

1. The diversity of dental patterns in orthopantomogram was 99.92% for full dentition and 99.28%, 98.22% for mandible and maxilla, respectively.

2. The diversity of molars and premolars in both jaws, values ranged from 92.13% to 96.04%. In contrast, that of anterior tooth area was 46.75% for maxilla and 19.02% for mandible.

Dental patterns in the orthopantomography are valuable in human identification not only in the presence of whole teeth, but also in the presence of only the posterior teeth. The use of orthopantomography is practically applicable for the identification of victims of mass disasters as well as wars.

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