Evaluation of adult dental patterns on orthopantomograms and its implication for personal identification: A retrospective observational study

Sumit Bhateja, Geetika Arora¹, Ruchita Katote²
Departments of Oral Medicine Diagnosis and Radiology and ¹Public Health Dentistry, Vyas Dental College and Hospital, Jodhpur, Rajasthan, ²BDS –IV Student, Dr. D.Y. Patil Dental College and Hospital, Pune, Maharashtra, India

Address for correspondence: Dr. Sumit Bhateja, 05072, ATS Advantage, Ahinsa Khand-I, Indirapuram, Ghaziabad - 201 014, Uttar Pradesh, India. E-mail: bhateja.sumit@gmail.com

Abstract

Background: Establishing a person's identity is a very complex process and is one of the main objectives of the forensic science also. Dental radiographs are certainly one of the most desirable pieces of antemortem evidence because of their highly objective nature as compared with other records. The aim of the present study is to establish the utility of orthopantomography for human identification.

Materials and Methods: A total of 300 digital orthopanographs were randomly selected from those stored at Oral Medicine and Radiology Department of Dr. D.Y. Patil Dental College and Hospital, Pimpri, Pune. Dental patterns were classified into nine types which are commonly observed in dental radiography. The diversity of dental patterns was calculated for full dentition, maxilla and mandible respectively. Results: Diversity of dental patterns observed for full dentition, maxilla and mandible were found to be 99.9%, 98.2% and 98.4% respectively. Conclusion: Findings suggests that orthopantomograms prove to be valuable aid in human identification.

Key words: Dental patterns, diversity, forensic odontology, orthopantomography

Introduction

Human identification has become fundamental in all aspects of human relationships, at both social and legal levels. It allows people to preserve their rights and have their duties demanded from both civil and legal standpoints. Identification corresponds to a combination of different procedures to individualize a person or an object. Most positive identifications today are based on fingerprints and dental examinations as these are fundamental procedures in medico legal death investigations including mass disasters.[3]

Typical antemortem dental records may include radiographs, dental charts (odontograms), both intraoral and/or extraoral photographs, dental casts, and notes.[3] 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.[4] Gustafson was the first to use orthopantomography in forensic practice for the purpose of identification.[5]
Compared with 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.\(^\text{[6-8]}\)

Validation of adult dental patterns in Indian subjects can aid in forensic investigations. Also study highlights the scope and use of orthopantomography for the purposes of forensic identification and thereby advocates the need for maintaining radiographic records in dental office as these practices not only improves the efficiency of a general dentistry office, but may also aid a forensic dentist in making identification.

Although a number of studies have been performed, very few were done involving the Indian population. The present study is aimed to fill this lacuna. In addition, the comparison of dental patterns with age groups is also performed to see if there is any correlation between the two, as this aspect could prove to be a valuable step towards the identification of an individual.

**Materials and Methods**

The present study is retrospective and study protocol was approved by the Institutional Ethical Committee.

**Study population**

A total of 300 (males = 150; females = 150) digital orthopantomograms were randomly selected from those stored at Oral Medicine and Radiology Department of Dr. DY Patil Dental College and Hospital, Pimpri, Pune. Sample was divided into six age groups as Group 1 (20-29 years), Group 2 (30-39 years), Group 3 (40–49 years), Group 4 (50-59 years), Group 5 (60-69 years), and Group 6 (70 years and above). Each study group comprised of 50 subjects out of which 25 were male and 25 were female.

**Selection criteria**

1. Only permanent dentitions were considered
2. Good quality radiographs were selected
3. Radiographs of completely edentulous patients were excluded.

**Data collection**

Dental patterns were classified into nine types which were commonly observed in dental radiography and converted into a consistent set of codes [Figure 1]. Table 1 presents dental patterns and codes. The diversity of dental patterns was calculated for full dentition, maxilla, and mandible.

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS Inc., 233 South Wacker Drive, 11th Floor, Chicago, USA) software version 11.5.

**Results**

Diversity of dental patterns observed for full dentition, maxilla, and mandible were found to be 99.9, 98.2, and 98.4\%, respectively [Table 2]. Most commonly observed dental patterns have been shown in Table 3. The total number of individual dental patterns in Group 1, 2, 3, 4, 5, and 6 were found to be 35, 36, 35, 30, 50, and 50 respectively as shown in Table 4 (individual dental patterns are those which are only once observed in the study group). On comparing patterns

![Panoramic radiograph with suitable annotations (commonly observed dental pattern)](image)

**Table 1: Classified dental patterns seen in orthopantomograms and corresponding codes**

| Code | Description |
|------|-------------|
| V    | Virgin tooth |
| X    | Missing tooth |
| I    | Impacted tooth |
| D    | Defect |
| R    | Residual root |
| T    | Root canal treatment |
| F    | Filling |
| P    | Prosthesis |
| S    | Supernumerary tooth |

**Table 2: Diversity of dental patterns**

| Area       | Diversity (%) |
|------------|---------------|
| Full dentition | 99.9          |
| Maxilla     | 98.2          |
| Mandible    | 98.4          |

**Table 3: Most commonly observed dental patterns**

| Area     | Dental pattern | Number | Percentage |
|----------|----------------|--------|------------|
| Full dentition | VVVVVVVVVVVV  | 31     | 10.3       |
| Maxilla   | VVVVVVVVVVVV  | 74     | 24.7       |
| Mandible  | VVVVVVVVVVVV  | 51     | 71         |
among males and females statistically insignificant results were obtained [Table 5]. Comparison of dental patterns between maxilla and mandible showed highly significant results [Table 6].

**Discussion**

The uniquely individual nature of a biological system such as the human body is reflected in such structures as finger prints, lip folds, palm prints, and retina. This individuality and the exposure in the body which allows observation and recording have caused these structures to be implicated in forensic science and to become important in identification.

Orthopantomographs provide a complete view of both jaws and teeth in one image and offer advantages in terms of dental record keeping. The availability of orthopantomographs and their conveying details have established this dental record as a valuable aid in comparing antemortem and postmortem dental characteristics. In addition, it is taken routinely on all ages in dental clinics. In this study, the diversity of dental patterns in orthopantomogram was evaluated in application to human identification.

The diversity of dental patterns for full dentition was 99.9% and separately for maxilla and mandible were 98.2 and 98.4%, respectively. These high diversity values imply the sufficient power of personal identification not only based on full dentition but also when only maxillary and/or mandibular records are available. These finding are in agreement to the previous findings by Lee et al., who observed 99.92% diversity for full dentition, 98.22 and 99.28% for maxilla and mandible, respectively.

The most prevalent dental pattern in whole study population for full dentition is created by all virgin teeth accounting to be 10.3%. These findings do not coincide with the findings of Lee et al., in which most common pattern observed were created by four impacted third molars and rest virgin teeth which accounted to be 2%. Possible explanation of deviation from previous findings could be due to the wide range of age groups studied in present study as compared to study by Lee et al., which may have taken orthopantomograms of young adults only that why more impacted third molars were present.

Maximum numbers of individual dental patterns were present in Group 5 and 6 for full dentition, this indicates that in advancing age there is more diversity of dental patterns but is statistically insignificant. Possible explanation to this could be since almost all of dental patterns are created from dental treatments for dental caries which is very common in older age groups.

On comparing patterns among males and females, statistically insignificant results were obtained in Group 1, 2, 3, 4, 5, and 6. These findings suggest that gender characteristics of dental patterns lack the discriminatory ability.

**Conclusion**

The results of this research show that the diversity of dental patterns in orthopantomograms is very high. 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 maxillary or mandibular teeth records. The use of orthopantomography is practically applicable for the identification of victims of mass disasters as well as wars.

Through our study we feel that dental patterns in orthopantomography will be of great use in the future of forensic odontology. It would therefore be beneficial to conduct further studies with larger samples and include other parameters for coding.

**Implications**

Validation of adult dental patterns in Indian subjects can aid in forensic investigations. Also study highlights the
scope and use of orthopantomography for the purposes of forensic identification and thereby advocates the need for maintaining radiographic records in dental office as these practices not only improves the efficiency of a general dentistry office but may also aid a forensic dentist in making identification.

References

1. Wagener GN. Scientific methods of identification. In: Stimson GP, editor. Forensic Dentistry. Boca Raton, Florida: CRC Press; 1997. p. 16-9.
2. Keiser-Nielsen S. Person identification by means of teeth. Bristol: John Wright and Sons; 1980. p. 668-81.
3. Adams BJ. The diversity of adult dental patterns in the United States and the implications for personal identification. J Forensic Sci 2003;48:497-503.
4. Happonen RP, Laaksonen H, Wallin A, Tammisalo T, Stimson PG. Use of orthopantomographs in forensic identification. Am J Forensic Med Pathol 1991;12:59-63.
5. Gustafson G. Forensic Odontology. London: Staple Press; 1966.
6. Lee SS, Choi JH, Yoon CL, Kim CY, Shin KJ. The diversity of dental patterns in the orthopantomography and its significance in human identification. J Forensic Sci 2004;49:784-6.
7. Biazevic MG, de Almeida NH, Crosato E, Michel-Crosato E. Diversity of dental patterns: Application on different ages using the Brazilian National Oral Health Survey. Forensic Sci Int 2011;207:240.
8. Adams BJ. Establishing personal identification based on specific patterns of missing, filled and unrestored teeth. J Forensic Sci 2003;48:487-96.
9. Thomas CJ, Kotze TJ. The palatal rugae in forensic odonto-stomatology. J Forensic Odontostomatol 1983;1:11-8.

How to cite this article: Bhateja S, Arora G, Katote R. Evaluation of adult dental patterns on orthopantomograms and its implication for personal identification: A retrospective observational study. J Forensic Dent Sci 2015;7:14-7.

Source of Support: Nil, Conflict of Interest: None declared

Author Help: Online submission of the manuscripts

Articles can be submitted online from http://www.journalonweb.com. For online submission, the articles should be prepared in two files (first page file and article file). Images should be submitted separately.

1) First Page File:
   Prepare the title page, covering letter, acknowledgement etc. using a word processor program. All information related to your identity should be included here. Use text/rtf/doc/pdf files. Do not zip the files.

2) Article File:
   The main text of the article, beginning with the Abstract to References (including tables) should be in this file. Do not include any information (such as acknowledgement, your names in page headers etc.) in this file. Use text/rtf/doc/pdf files. Do not zip the files. Limit the file size to 1 MB. Do not incorporate images in the file. If file size is large, graphs can be submitted separately as images, without their being incorporated in the article file. This will reduce the size of the file.

3) Images:
   Submit good quality color images. Each image should be less than 4096 kb (4 MB) in size. The size of the image can be reduced by decreasing the actual height and width of the images (keep up to about 6 inches and up to about 1800 x 1200 pixels). JPEG is the most suitable file format. The image quality should be good enough to judge the scientific value of the image. For the purpose of printing, always retain a good quality, high resolution image. This high resolution image should be sent to the editorial office at the time of sending a revised article.

4) Legends:
   Legends for the figures/images should be included at the end of the article file.