ORIGINAL ARTICLE

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

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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 orthomopantographs 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.[1] Most positive identifications today are based on fingerprints and dental examinations as these are fundamental procedures in medico legal death investigations including mass disasters.[2]

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]

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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.[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 orthomopantographs 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

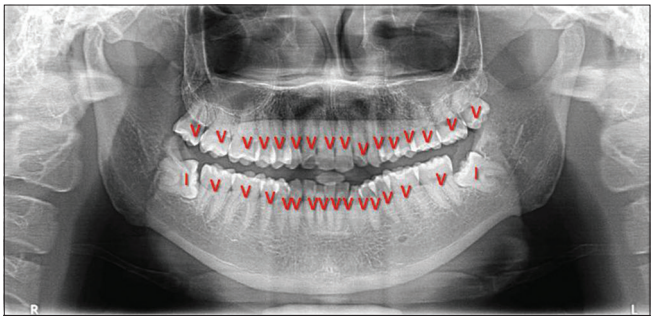

Figure 1: Panoramic radiograph with suitable annotations (commonly observed dental pattern)

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

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
S (Supernumerary tooth)	Presence of 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	VVVVVVVVVVVVV VVVVVVVVVVVVV	31	10.3
Maxilla	VVVVVVVVVVVVV	74	24.7
Mandible	IVVVVVVVVVVVVI	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.[9]

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 orthopantomograms 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.[6]

Table 4: Number of individual dental patterns for full dentition in different adult age groups

Age groups (*N*)	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Full dentition	35	36	35	30	50	50
Maxilla	19	18	19	17	48	49
Mandible	29	23	22	24	49	50

N=No. of dental patterns

Table 5: Comparison of individual dental patterns for full dentition among males and females in each adult age group

Age groups (*N*)	Sex	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Full dentition	M	21	18	18	17	25	25
	F	18	22	20	16	25	25
	χ^2	36.44	37.40	33.86	27.86	50.00	50.00
	P value	0.401	0.451	0.474	0.525	0.433	0.433
Maxilla	M	12	9	14	11	25	24
	F	9	13	10	9	23	25
	χ^2	22.53	17.66	15.28	14.63	50.00	50.00
	P value	0.209	0.410	0.642	0.562	0.355	0.394
Mandible	M	17	12	11	15	25	25
	F	16	15	14	13	24	25
	χ^2	29.33	21.33	20.92	24.00	50.00	50.00
	P value	0.396	0.500	0.463	0.404	0.394	0.433

N=No. of dental patterns

Table 6: Comparison between the diversity of dental patterns between maxilla and mandible

Arch	Diversity (%)	Chi-square value (χ^2)	*P* value
Maxilla	98.2	30695.576	0.000
Mandible	98.4		

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*.,[6] 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*.,[6] 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.

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