REVIEW ARTICLE

Importance of Diversity in Dental Pattern for Personal Identification: A Review

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Abstract:

Forensic Odontology is a branch of forensic science that has the proficiency to establish a person's identity. The combination of virgin restored, unrestored, missing, filling, impacted, endodontic treatment, and decayed used as dental codes assigned to the specific tooth that encompass the unique dental pattern to determine person identification in single or mass fatality cases. The aim is to assess the accuracy of the diversity of dental patterns using radiographs and non-radiograph dental records and also to generate responsiveness among dentists about their role in human identification and the significance of sustaining complete accurate dental records. The published articles mostly exhibited a high diversity of dental patterns observed for full dentition ranging from 88.8% - 99.92%, for maxilla, 59%- 98.8%, and for mandible 82.00% -92.8% established by the various author depending on the population size. The frequency of virgin teeth was relatively found high in the young as compared to adults (6.67% - 54.90%), the filling of the tooth (7.00% - 11.45%), a crown (1.10%), and impacted third molar (5.33%) that can also be used as the discriminating criterion of education level, socio-economic status of the person. The conclusion demonstrates that the diversity of dental patterns may be a very substantial and valuable tool in human identification not solely in the occurrence of whole teeth, but also in the occurrence of only the maxillary and mandibular teeth records. The excellence, number, and presence or absence of dental treatment can be considered on the person's socioeconomic status and education level.

Keywords: Forensic odontology; Forensic dentistry; Dental patterns diversity; Dental records, Personal identification.

Introduction:

According to Keiser-Neilson (1970) "Forensic Odontology is that branch of dentistry which deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of dental findings in the interest of justice."[1] In the current situation, Forensic Odontology has emerged as an integral part of a large international forensic education organization like the American Academy of Forensic Sciences (AAFS) and the International Association of Identification (IAI) with an aim is to identify the unidentified person(s) based on the individual characteristics of teeth, which is based on the principle that "neither two mouths nor teeth are identical" and mainly involves the comparison of an ante-mortem dental record for identification[2]. Identification of a person has become an elementary feature of human relationships, on moral, social, and legal grounds. It permits people to assist their rights and have their duties demanded from every civil and legal viewpoint. The principal attributes used for human identification in Forensic are Fingerprints, DNA, and Dentition.[3]

The most precise technique for human identification is fingerprinting, however, it is restricted to cases like disfigured, highly decomposed, severely burnt, or highly fragmented bodies in single or mass fatality cases. Simultaneously, DNA is the most specific human identification technique but entails extensive setup and time.[4]

Teeth constitute a suitable strong box with unique morphological and characteristic features where other shreds of evidence lack, to be the hardest, strongest calcified, and well-protected structure in the human body that can withstand decomposition at high temperature[5] with a hardness value of 270- 350 knoop hardness number for enamel and dentine. Hence, teeth are likely to be a line of evidence that usually turns out to be the most consistent comparative instrument.[6,7]

Human dentition consists of incisors, canine, bicuspid, and molar teeth that differ in shape, size, interspace, and their arrangement in the mouth completely different among individual and possesses distinctive characteristics referred to as "tooth" class characteristics that set up the idea of identification, at the same time different characteristics like filling, missing, impaction, crowding, any dental pathology, etc., makes the dental pattern unique in each person that aid in the identification of missing person identity.[8,9] On the other hand, oral jewelry has also been considered as an anthropological characteristic of identification to extract information of socio-economic eminence, religion, sex, and ethnicity.[10,11] and are highly satisfactory and approved by the dentists and could aid in Forensic Dental identification.[12]

The comparative recognition is predicated on comparing antemortem and post-mortem dental records that involve dental charts, radiographs, clinical photographs, treatment notes, and study cast dental prostheses.[13] Thus, maintaining ante-mortem dental records must be at minimal costs practical, and easily retrievable when required.[14]

The dental pattern is illustrated as "the combination of distinct codes designated; to specific tooth conditions namely virgin,

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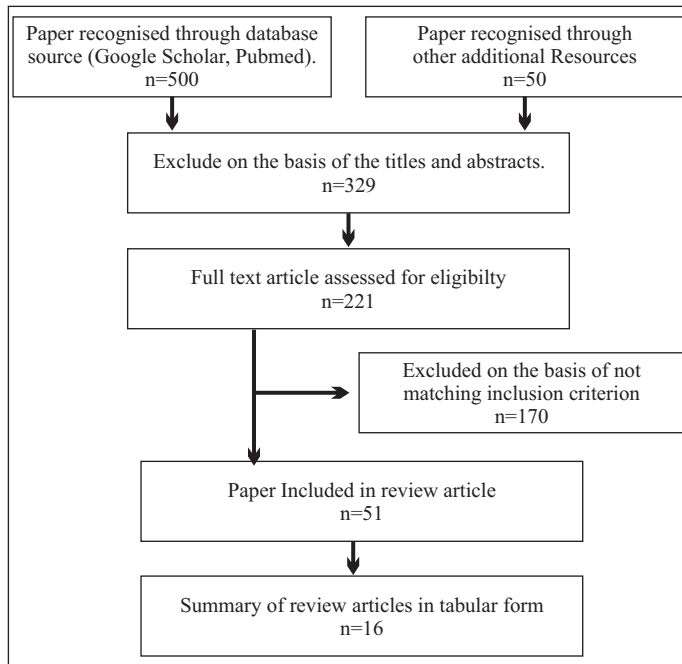
Figure 1. Selection strategy.
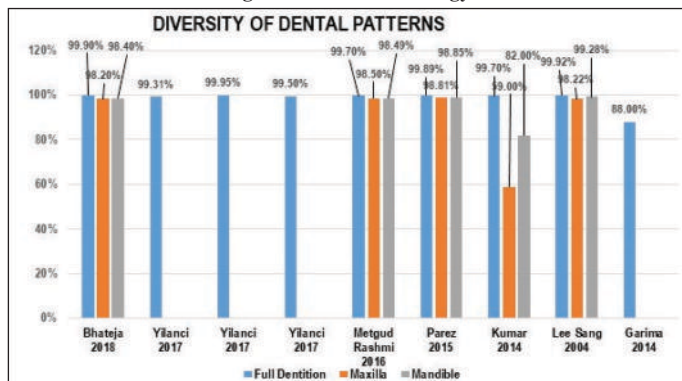
Figure 2. Diversity of dental patterns.

Figure 3. Dental codes.

Figure 4. Result of martin-de-las-heras- dental codes.

Table 1: Inclusion and exclusion criteria.

Characteristic	Inclusion criteria	Exclusion criteria
Population	Any country aged > 18 years, Permanent tooth (major evaluation), deciduous tooth	Edentulous
Intervention	Studies with Good quality Radiograph complete and accurate radiographic and Non-Radiographic Dental Records, Records of dentulous and partially dentulous teeth showing a dental pattern	Cleft Lip/ Palate, complete edentulous, any other studies which defy inclusion criteria
Comparison	Studies on University, Population of same Country	Studies that defy inclusion criteria
Result	High dental pattern diversity perceived	Studies that report any dental anomalies and any other methods
Methodological study	Pilot Study, Cross-sectional, retrospective study, Longitudinal studies, Survey	Qualitative

missing, filling and restored teeth on entire dentition, or groups of teeth."[15] The outcome of the observation is noted and charted in a non-radiographic configuration pattern as ante-mortem dental records.[7,16]

The radiographs dispenses a great help in matching ante-mortem dental features and post-mortem dental features, as its outline, the complete perspective of the jaws and teeth, and other features in a single image.[17] Excellent radiographs (film or digital) are advantageous for illuminating 'unrevealed dental details' along with tooth-color restorations that are easily undetected during post-mortem examination and disclose any fresh or longstanding trauma that could lead from identification from pins, wires, and plates that have been used by the dentist during treatment if they have manufacture's number or codes.[18]

"A dental record is a legal document that contains all subjective and objective information about the patient and is in the dentist's possession."[19] including written notes in the form of the patient's chief complaint, medical history, any drug allergy, clinical examination, d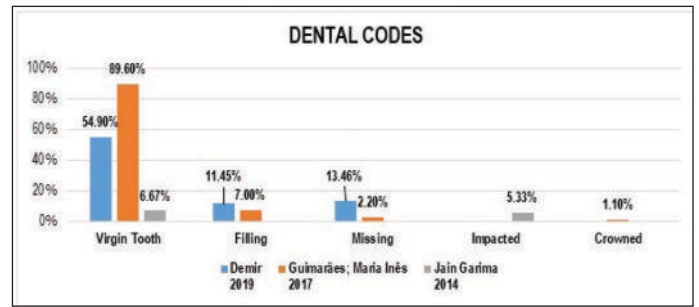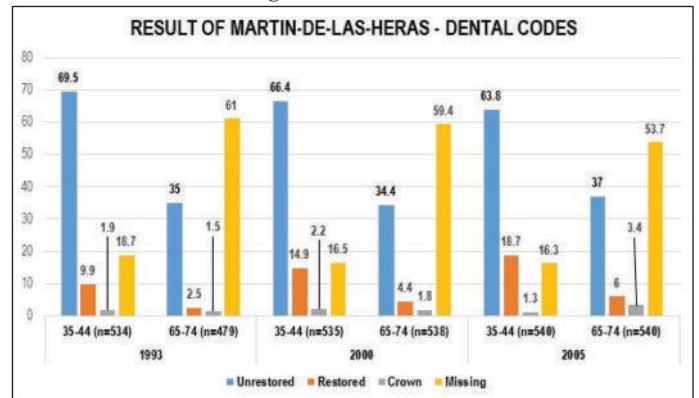iagnosis, dental charts (missing, filled, decayed, root stump, impaction), the treatment planned, and subsequent follow-up, radiographs, clinical photographs, study models, referral notes or specialist reports, laboratory prescription, any other bits of information. It should be noted down more precisely and accurately, as any inaccuracy, inadequate records, fraudulency, poor quality of radiographs, and different charting classifications with different terms may leave the record pointless.[20]

Materials and methods:

Study protocol: The search approach balances suggestions for high vulnerability versus viability and was directed by the literature concerning the search in the review as well as the outline of the review.

Table 2. Tabular summarisation of various studies.

Year	Author	Country	Population size	Parameters	Result
2020, January	Guima-rães et al.	Portuguese military population	1636 Dental data Portuguese Armed Forces	Data collection using Forensic Dental Symbols and Dental Encoder, Microsoft Excel, and SPSSV.23	The highest frequency observed was "unrestored" and less missing and high in the younger group<32 years. Although the statistical results are inconclu-sive it allows individual classification based on age.
2019, Aug-ust	Demir et al.	Ankara University, Turkey	Randomly Selected 503 Nos. OPG	Codes set were V, M, C, DI, FC, E, SC, A, I, P, D, R, BL, U, DM, FR. Permanent teeth (major evaluation criteria), and deciduous teeth were considered.	Virgin tooth (54.9%), Missing (13.46%), and Filling (11.45%) were perceived. Virgin Tooth is more commonly found in the young age group (62.96%), No FR, low or primary educated with 50.62%, and highly educated people with 57.90% seen. Middle-age (40.17), and missing most commonly seen in 35.66% and Virgin with 30.51%
2018, Aug-ust	Gorza et al.	Three Private Clinics,	12 Nos. OPG Showing complete Shedding, Permanent and Unrestored Teeth. Patients were selected as simulated PM radio-graphs, 24 more OPG with Mixed Dentition.	The Time-lapse between the AM and PM was between 3 and 18 years. The age of the indivi-dual of the AM radiograph ranged between 8 and 13 years. The selected radiograph was photographed by using a Nikon D90 Camera. A web-based survey done on Google form	The Accuracy of the methodology was 75.4%, the Sensitivity was 53.5% and the Specificity was 86.4%.
2018, April	Bhate-ja, et al.	D Y Patil Hospital, Pimpri Pune	Randomly Selected 300 Nos. OPG(male = 150, female+ 150)	The tooth was coded as V, X, I, D, R, T, F, P*, S. Population was categorized into six age groups years (20-29), (30-39) 40-49), (50-59), (60-69). And 70 years above.	The diversity of Dental Patterns observed for Full Dentition was 99.9%, Maxilla 98.2%, and Mandible 98.4%. Comparison between Maxilla and Mandible was observed highly significant.
2018, July - Sept.	Guim-araes et al.	Spanish & Portuguese Military personal	5136 Nos. Dental Records of Spanish and Portuguese Military Personnel	Dental Data were documented using Forensic Dental symbols for Dental Encoder	The frequency of unrestored first molar was lowest, with the highest frequency of unrestored teeth (>90%) in upper, lower anterior, and lower premolar teeth. The highest frequency of missing teeth for the third molar was also found (28%).
2017, Febr-uary	Guim-araes et al.	Portuguese	595 Nos. Dental Records sample of the military population of 10 years after treatment. Analyzed 19040 teeth.	Information is collected through Forensic Dental Symbols into the Dental Encoder. It includes 33 Representative Dental Associations of five continents' feedback, as an extension of Spanish study.	The Unrestored (89.6%), Restored (7.0%), Missing (2.2%) and Crowned (1.1%).
2017, March	Yilanci et al.	Hacettepe University	Randomly Selected 250 Nos. OPG, 169 Nos. Radiographs were used for analysis aged between 15 to 84 years	V, M, D, R, F, C, B, P**, T, I, A, and others were given Dental Codes to the tooth.	The diversity of dental patterns for full dentition was 99.31%, 99.95%, and 99.5% Overall Intra and inter-observer agreements were 97.48% and 94.48%.
2016, May	Metgud et al.	Pacific Dental College & Hospital, Udaipur	Randomly Selected 300 Nos. OPG	V, R, M, I code given to tooth. Only Permanent Teeth, Dentulous, and Partially Dentulous teeth were included.	The diversity of dental patterns recorded for Full Dentition was 99.7%, Maxilla was 99.5% and Mandible was 99.49%.
2015, Sept-ember	Deitos et al.	Brazilian adolescent	Clinical Data of 16,833 subjects in 2003 and 5,367 in 2010 representative sample of 15 -19 years as per WHO Parameters	H, D, F, M, and P were given Dental Codes to Tooth. Non- Erupted teeth, deciduous teeth, Teeth with Sealant or trauma not incorporated	The national and regional conditional diversity values preconceived for Complete and Partial dentition were 0.911 – 0.997, P > 0.005 are alike to the diversity patterns values of mitochondrial DNA.
2015, Dece mber	Perez	Lima, Peru, Peruvian Citizens	900 Nos. OPG, Retrospective study between 2013-2015	V, M, I, D, R.T, F, P. The diversity was calculated by Simpson's Diversity Index	The Diversity Reported in Full Dentition was 99.8%, in Maxilla 99.81%, and in Mandible 99.85%.
2014, Febru-ary	Kumar et al.	AIIMS, New Delhi	Randomly Selected 300 Nos. OPG	V, R, M, and I were given codes to tooth and Data Analysed by using Statistical Package for Social Science (SPSS) version software.	The diversity of reported for Full Dentition was 99.7%, in Maxilla was 59.0%and in Mandible was 82.0%
2014, Dece mber	Jain et al.	AB Shetty MIDS, Mangalore, Karnataka	Randomly Selected 150 Nos. OPG	Win ID coding system consists of primary and secondary codes. (Table-3-4)	The Unique Dental Pattern observed was 88%. The most common pattern observed was Intact teeth (6.6 7%), Impacted or Missing Third Molar Teeth 5.33%. Maximum Variability was seen Maxilla > Mandible
2011, April	Biaze-vic et al.	Brazil	35,613 Nos. Individuals Records from the Brazilian National Oral Health	Data from the last 3 contemporary Spanish National Oral Health Survey years 1993, 2000, and 2005 age groups: 15-19, 35-44, and 65-85; D, M, P, I were given Codes to the tooth.	The Prevalence of healthy teeth is found more in young than adults. (Young > Adult)
2009, Febru-ary	Martin-de-Llas-Heras et al.	Spain	Data from 3166 Nos. Adult	Data extracted from the last 3 contemporary Spanish National oral Health Survey years 1993, 2000, and 2005.	Total diversity values were low and Heterogonous. Conditional Diversity (0.99) was obtained.

2007, June	Al et al.	School of Dental Science, University of Melbourne Australia	An Open disaster was simulated. 52 Nos. Fragmented Remains made of acrylic replicas 77 Nos. provisional victims, Mandibles (26), Maxillae(6), Skulls(17), Jaw Fragments (3). were exemplified	Compare Dental Characteristics on DAVID and WINID3 system and manual.	Manual matching of dental characteristics performed better than both programs (p<0.001) yielding 29 identification. Eleven and Six positive matches were found on DAVID and WINID3 programmes respectively. (p=0.185).
2004, July	Lee	Dental Hospital Yonsei	Randomly Selected 300 Nos. OPG	The tooth was code V X, I, D, R, T, F, P*. The permanent tooth was considered.	The Diversity of Dental Patterns observed for Full Dentition was 99.92%, and for Mandible was 99.28% higher than maxilla which was 98.22%.

Table 3. Categorization of dental codes.

Code	Name	Characteristics
V/H	Virgin/Higid	No evidence of caries, dental treatments, or any abnormality.
X, M	Missing	Congenital missing of a tooth or extracted tooth.
C, D	Caries and Defect	Defect, Decay cavity, tooth fracture or fallen out fillings
F	Filling	Any kind of restoration filled in the tooth cavity
T, E	Root canal/ Endodontic treatment	Root canal filled tooth by endodontic treatment
I	Impacted	Unerupted or impacted tooth.
P	Pontic of fixed prosthesis	Parts of fixed dental prosthesis on teeth that supported Pontic
P*	Prosthesis	Tooth with Crown
S	Supernumerary tooth	Presence of Supernumerary tooth
FC	Dental filling with Caries	Filling and cavity together
SC	Single Crown	A restored tooth with a single unit crown
A	Abutment of Fixed Dental Prosthesis	Part of dental prosthesis on teeth that supported Pontics
D*	Deciduous Tooth	Presence of baby teeth in any dental arch for adults.
R	Residual Root	Presence of remained root tissue in the bone.
BL	Alveolar Bone	Loss of bone and connective tissue attachment to the root of the root of the tooth.
U	Unrestored Prepared Tooth	Prepared tooth without a crown
DM	Dental Mutilation	Dental modification, trimming or piercing.
FR	Fractured Root	Presence of fractured line at the Root.
B	Pontic	Bridge Pontic.
P**	Implant	Dental Implant
A	Dental Anomaly	Persistent Deciduous tooth with or without its permanent tooth is coded as a dental anomaly with the use of only one code.

Search strategy: The review was executed by adapting a manual search strategy on a Google scholar, PubMed –Medline search for the last 21 years (from 2000 to 2021) by using the key term: Forensic dentistry, Forensic odontology dental pattern diversity, dental records, and dental radiographs. The selection of studies was based on revising the titles and abstract to recognize the related publications from which the full text was subsequently attained.

Eligibility criteria: The selection of studies was based on revising the titles and abstract to recognize the related publications from which the full text was subsequently attained. The final inclusion supported inclusion and exclusion eligibility criteria outlined by the authors within the English language as given in Table 1.

Results:

Literature search and screening: The review paper for analysis included database sources n= 500 and other additional sources n= 50. The established search series scrutinized n =221 studies. n =51 were preferable for inclusion after viewing the title\abstract and full text and removing duplicate articles (Figure 1)

Data extraction: Tabular summaries are tailored to the characteristics of the incorporated review to capture information relevant to our purpose. An overview of these studies encompassing year, author, country population size, parameter details, and study outcomes (Table 2) with categorization of dental codes (Table 3) Win ID Coding system; Primary Codes (Table 4), and Secondary Codes (Table 5).

Findings : Figure 2 illustrates the proportion of diversity of dental patterns established by various studies in several different countries. The high and significant diversity of dental patterns full mouth, maxilla, and mandible was observed that encourage an advantage in the process of Forensic identification of a person(s). Bhateja et al. (2018) observed dental diversity in 300 populations of Pune were 99.9%, 98.2%, 98.4% in full dentition, maxilla, and mandible from a panoramic radiograph.[3] Yilanci et al. (2017) evaluated that dental diversity in 169 populations at Hacettepe University for full dentition was 99.31%, 99.95%, 99.95% when 4 and 6 base parameters and all 11 dental parameters were used on OPG.[22] Metgud et al. (2016) evaluated dental pattern diversity in the population of 300 at Udaipur were 99.70% (full dentition), 98.50% (maxilla), and 98.49% (mandible)[4] Perez et al. (2015) evaluated the diversity of dental patterns in 900 Peruvian populations 99.89 % (full dentition), 99.81% (maxilla), and 99.85% (mandible).[23] Kumar et al. (2014) evaluated the diversity of dental patterns in 300 Delhi, AIIMS population were 99.7% (full maxilla), 59.0% (maxilla), and 82.00% (mandible)[24] Lee et al.(2004) evaluated 300 populations at Yonsei University were 99.92% (full dentition), 98.22% (maxilla), 99.28% (mandible).[25] Jain et al. (2014) evaluated the diversity of dental patterns at mangalore in 300 populations was 88.8% unique.[14] Gorza et al. (2018) observed the accuracy diversity of dental patterns was 75.4%, the sensitivity was 53.5%, and also the specificity was 86.4%.[26]

Figure 3 illustrates the proportion of virgin, filled, missing, impacted, and crowned rely upon the oral condition of the mouth to establish the uniqueness of diversity of dental patterns and are often used as an ante mortem dental record for Forensic identification of a person(s). Demir et al. (2019) observed the frequency of teeth was virgin tooth with 54.98%, Filling with 11.45%, and missing with 13.46%. virgin tooth is more commonly found in the young age group (62.96%), no FR, low or primary educated with 50.62%, and highly educated people with

Win ID Coding system[21] used was as follows:

Table 4. Primary codes.

Code	Interpretation
M	"Mesial surface of the tooth is restored"
O	"Occlusal surface of the posterior tooth is restored"
D	"Distal Surface of the tooth is restored"
F	"Facial Surface of the tooth is restored"
L	"Lingual surface of the tooth"
I	"Inscial edge of the anterior tooth is restored"
U	"Tooth is unerupted"
V	" Non-restored tooth"
X	"Tooth is missing-extracted"
J	"Tooth is missing post-mortem or the tooth's clinical crown is not present for examination. Also used for an avulsed tooth. The root or an open socket is present, but no other information is available"
/	"No information about tooth is available"

Table 5. Secondary codes.

Codes	Interpretation
A	"An anomaly is associated with this tooth. Specifies of the anomaly may be detailed in the comments section"
B	" tooth is deciduous"
C	"Crown"
"Resin	filling material"
" Gold	Restoration"
H	"Porcelain"
N	"Non-precious filling or crown material. Includes stainless steel"
P	"Pontic. The primary code must be X to indicate missing tooth"
R	"Root canal filled"
S	" Silver amalgam"
"Denture	tooth. Primary code must be x to indicate missing tooth"
Z	"Temporary filling material. Also indicates gross caries (used sparingly)"

57.90% seen. middle-age with 40.17%. The most common dental diversity was missing Tooth seen in 35.66% and virgin tooth with 30.51 %.[27] Guimaraes et al. (2017) observed the unrestored (89.6%), Restored (7.0%), missing (2.2%), and crowned (1.1%).[28] Jain et al. (2014) observed the unique dental pattern observed was 88%. The most common pattern observed was intact teeth (6.67%), impacted or missing third molar teeth 5.33%. Maximum variability was seen in the maxilla than the mandible.[14] Guimaraes et al. (2020) observed a very high frequency of unrestored and missing teeth in younger age group <32 than adult people. Although the outcome was statistically inconclusive, it acknowledges the individual classification based on age.[29] Deitos et al. (2015) observed clinical data of 16,833 subjects in 2003 and 5,367 in 2010 representative sample of 15 - 19 years as per WHO parameters in Brazil population conditional diversity value calculated for complete and partial dentition was $0.911 - 0.997$ ($p>0.005$).[30]

Figure 4 illustrates Martin-De-Las- Heras et al. (2009) categorized dental codes and dental patterns of six datasets according to the National Oral Health Survey for 1993, 2000, and 2005 year and comprised 2 adults age groups (35-44 years, 65-74 years) in 3166 Spanish population classified as unrestored, restored, crown, missing, edentulous, All unrestored, unique, and other Non-Unique patterns observed total and conditional diversity revealed total diversity was low and heterogeneous but conditional diversity was high and homogenous calculated. Once data were combined, the high diversity combined value was above 0.99 attained.[31] Bizevic et al. (2011) observed the prevalence of healthy teeth is found more in young than adults in 35,613 numbers of Brazilian population records from National Oral Health (1993, 2000,2005, age group of 15-19,35-44, 65-85 years).[32]

Al et al. (2007) simulated an open disaster and compared dental characteristics on DAVID & WINID3 system and manual. Manual matching of dental characteristics performed better in both programs ($p<0.001$).[33]

Discussion:

The approach of differentiating living or deceased people from others is called identification which will become more essential in Forensic identification related to dubious deaths in single and mass fatality instances for social, religious, humanitarian, ethical, and legal instances.[34,35,17]

This review represents the contribution of dental identification and its significance in personal identification in single or mass fatality cases. Dental identification is a simple and powerful approach to recognizing people, established by reviewing ante-mortem and post-mortem records to categorize matching features for comparison.[36]

Forensic dentistry plays a significant role in the identification of these individuals when all other means of identification fail. The distinctive nature of our dental structure and also the settlement of custom restorations confirm accuracy when techniques are appropriately employed. Dental identification takes two forms. First, comparative identification is employed to determine the person's identity by the ante-mortem dental records of a person. Second, post mortem dental profiling is formed by the Forensic Dentist, when ante-mortem dental records don't seem to be available.[37] Forensic Dentistry involves the processing, review, evaluation, and presentation of dental evidence to contribute scientific and objective data to legal processes.[38]

The basis of this review is on the information related to distinctive features of dental diversity and their frequency found in the society that have been collected from earlier studies that were conducted in different time periods by different authors. This study also emphasizes generating awareness among dentists of their role in the personal identification of dentists in India. Forensic dental research, in particular, relies upon the availability of dental records, and consequently, dental records confirm to be a valuable tool in such cases.[39]

Dental records serve as a very beneficial implement in Forensic Odontology as they can exhibit important information like name, age, sex, missing tooth, intact tooth, filled and impacted tooth, treatment notes, dental pathology, and so forth of deceased people or victims, can be acquired during a routine dental examination.[19] The study conducted on the maintenance of dental records by Sengupta et al. (2014) and observed that the preservation of dental records was done by 86% of dentists and 36% were afraid of misapplication of records when calling for identification of victims.[40] According to the study by Preethi et al. (2011), 79% of

dentists preserved dental records while 12 % only kept complete dental records.[41] The poor quality of dental records exhibited by the insufficiency of data, improper and outdated dental information, and not following the guidelines can completely deter forensic identification.[20] Astekar et al. (2011) observed that merely 38% of the dentist were conscious of sustaining dental records and 62% of the dentists did not preserve any kind of dental records.[42]

Adam (2003) stated that dental diversity was enough for Forensic identity even in absence of a dental radiograph. He compared only missing restored and unrestored teeth on a simple dental chart. Adam reported on the diversity of adult dental patterns using empirical observations of large reference data sets and showed the diversity using non- radiograph dental comparisons on dental charts.[43] Dental charts may be subjective, but dental radiographs are more objective and show relatively fewer errors when compared by post-mortem investigators for positive identification. So there is a clear need for the diversity of dental patterns in panoramic radiographs.[25]

Keiser-Neilson (1980) has ascertained 12 well-matched characteristics between AM and PM dental records to determine positive identification; though this cannot be a common valid statement.[44] However, Buchner (1985) expressed that only a solely one tooth or jaw fragment may well be enough to substantiate a positive identification.[45]

Madi et al. (2013) established a study on 2000 multinational populations exhibiting 1031 distinctive dental situations for each comprising tooth. Virgin teeth were most frequently found and the first molar was determined as the most amount of missing, filling, or restoring with the Crown. The comparison of the diversity of dental patterns was prepared on the data of dental records that were important in Forensic identification.[20]

Silva et al. (2016) inspected the role of the endodontic dental radiograph in Forensic Dentistry as evidence in criminal cases. In the first examined cases, the mandibular left premolar was detected as a root canal-treated tooth in AM radiograph of the victim that was later confirmed in the PM radiograph. In the second case, Root canal treatment was perceived in the mandibular left first molar through AM dental radiograph, confirmed when the comparison is done with PM dentalradiograph. This outcome suggests that even a single dental situation is important in terms of Forensic investigation.[46]

Ante-mortem dental radiographs along with intraoral or extra-oral radiographs are extensively used in view that they are easily available and transferrable because of the recent advantage of digital radiography, permitting data to be transferred. The occurrence of dental diversities is closely associated with dental health status and relies on age, oral hygiene awareness, education, economic status, and the variations within the dental caries levels among countries.[23]

The frequency of high diversity of dental patterns indicates the ample power of personal identification not solely supported full dentition but conjointly once when molar and premolars are available. The diversity of anterior teeth had low diversity in contrast to full dentition or molar and premolars due to the lack of complicated anatomical structures in anterior teeth and the self-cleaning consequence of saliva.[25]

Guimaraes, et al. (2018) observed in 5136 Spanish and Portuguese military populations highest frequency of the highest frequency of unrestored teeth (>90%) in upper, lower anterior, and lower premolar teeth. The highest frequency of missing teeth for the third molar was also found (28%).[28]

Several Coding systems can be used to record dental findings like the "CAPMI" system, "Win Id", "Plass data DVI International software", "dental encoder", etc.[47-49] and software like "The Dentist," "Densoft Programme," can be used to sustain dental records from the internet. Under Article 51A (h) of the constitution of India, there is an ethical responsibility on the doctor, to maintain and preserve medical, medico-legal, and legal documents in the best interests of social and professional justice.[50] The durability of the teeth and their associated tissues to peri and post-mortem assaults dispense extensive information for those who are interested in human identification.[51]

Conclusion:

The conclusion of this review demonstrates that the diversity of dental patterns may be a very substantial and valuable tool in human identification not solely in the occurrence of whole teeth, but also in the occurrence of only the maxillary and mandibular teeth records. Related to dental charts, dental radiographs are more precise and show relatively less prone to error. The accomplishment of Forensic identification through dental evidence in large part relies upon the availability of accurate and complete ante-mortem dental records. It is the accountability of dentists to preserve dental legal documents in the interest of social professional justice.

It is concluded that dental patterns using dental radiographs will be of great use in the future of Forensic odontology. It would thus be a suggestion to conduct furthermore studies using extensive data and include different other parameters to check more accurate results for identification purposes.

It was concluded that:

1. Ante-mortem dental records can be used as the most reliable and effective tool in Forensic investigation for both single and mass fatality cases when recorded accurately.

2. Virgin tooth can be measured to distinguish between younger adults (high frequency) and elders (low frequency) in terms of age.

3. Restorative and prosthetic procedures can be used as the discriminating criterion of educational level as the frequency of restoration and dental treatment increases with the education level.

4. The excellence, number, and presence or absence of dental treatment can be considered to the socioeconomic status of the person.

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