Short Survey

The role of charting dental anomalies in human identification

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Introduction

Forensic Dentistry seems to have the least official affiliation despite its fundamental contributions to the establishment of identity and its popularity in the field of research in several countries [1,2]. There are several cases where human identification through dental means could have been helpful but have not been applied which could be explained by the lack of awareness and the unavailability or unreliability of dental records in these countries [3–6]. The comparative dental analysis of ante-mortem (AM) dental records and post-mortem (PM) dental findings is dependent on the reliability of dental records received. The more accurate, complete and up-to-date the dental records are, the easier and faster the identification process will be [7].

Unreliable dental records may lead to wrong conclusions when it comes to identification [8]. It is seen that only strict medico-legal and ethical codes would encourage dentists to keep adequate dental records of patients [9]. In numerous countries, even though laws on maintenance of dental records exist, many dentists do not maintain adequate dental records [10–13]. Several reasons act as barriers to maintaining reliable dental records such as lack of time due to increased patient inflow, finance based reasons including lack of computer facilities and storage space, the attitude of the dentist along with his/her awareness on the forensic value of dental records, the lack of a regulating body for checking the quality of the records maintained, etc. [11].

With the introduction of Preventive Dentistry from the 1960s, the awareness has increased not only on taking timely dental treatments but also on how to prevent dental caries and periodontal diseases. This awareness has brought about a significant decrease in the occurrence of dental caries, and thus, decreasing the number of dental restorations received per patient [14]. This would hinder the normally followed comparison pattern of using dental restorations/treatments for human identification; hence, existing dental anomalies (even minor localized anomalies such as mild rotations, mild crowding, spacing, etc.) could act as a unique identifying dental feature for that particular individual [15,16]. For example, a forensic dentist identified a 23 year old woman using her AM photograph to analyze a positional anomaly of a buccally placed (placed closer to the cheek) canine which acted as a key identifying feature [17]; however, tooth position and dental anomalies can only aid human identification if they are recorded in the AM dental records, either in dental charts, radiographs or photographs. Thus, the aim of this study was to evaluate the awareness of dentists on charting dental anomalies irrespective of the patient’s chief complaint and the importance of maintaining dental records for forensic and medico-legal purposes.

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http://doi.org/10.1016/j.fsir.2020.100086

Received 3 February 2020; Received in revised form 17 March 2020; Accepted 24 March 2020
Available online 1 April 2020
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Materials and methods

An online survey-based study designed using Google Forms (© 2019 Google Inc., v 0.8) was conducted on dentists from the states of South India namely Karnataka, Kerala, and Tamil Nadu. Section 1 of the survey requested information about year(s) of experience as a dentist, place of work (state) and type of establishment (private or public).

Section 2 presented a dental charting task composed of an occlusal image of the upper and lower dental arches containing teeth numbered by the FDI (World Dental Federation) system as seen in Fig. 1. Apart from dental treatments, teeth presented features/anomalies created by an animation artist using Photoshop CC 2017. Anomalies of position included rotation (tooth 35) and transposition (tooth 13) and anomalies of shape included talon’s cusp (tooth 41) and cusp of carabelli (tooth 26) as seen in Fig. 2. Dentists should chart the teeth by choosing only one option out of 24 as seen in Table 1. They could also specify other additional findings. Sections 3 and 4 were composed of eight questions on recording dental features and maintaining dental records respectively.

The link of the survey was emailed to 152 dentists and was live for a period of one month. The responses to the surveys were automatically collected in forms and charts and further statistical analysis was carried out using the “pivot tables” option in Microsoft Excel (2016).

Results

Sections 1 and 2

Out of the 101 dentists (71 % of response rate), 86 presented 0–5 years of clinical experience, followed by 15 who had the clinical experience of 5–10 years. The dentists were from the states of Karnataka (50), Tamil Nadu (10) and Kerala (41) belonging to public (7) and private (94) establishments.

According to the results, anomalies of shape were the most neglected. The accessory cusp present on 25 was mentioned only by 11.9 % of the dentists. Similarly, the cusp of Carabelli present on 26 was only mentioned by 12.9 %. Talon’s cusps on teeth 32 and 41 were charted only by 5.9 % and 9.9 % of the dentists respectively. It was also observed that 17.8 % misnamed the accessory cusp as a Talon’s cusp. The percentage of correct answers for anomalies of shape was observed to be extremely low as seen in Fig. 3.

Anomalies related to position were also overlooked. The rotated teeth 35, 32 and 42 were charted only by 36.6 %, 6.9 %, and 46.5 % respectively. Midline diastema in the upper arch was mentioned by only 11.8 % and crowding in the lower anterior teeth was mentioned only by 22.7 %. Teeth 13 and 23 presented transposition but only 5.9 % of the dentists charted the anomaly correctly. It was also seen that decay-related findings were also overlooked such as the pit shaped decay on teeth 38 and 48. The distribution of correct answers for anomalies of position was comparatively better than the percentage observed in case of anomalies of shape as seen in Fig. 4.

A “Scale of Forensic Significance of Dental Features” was created to interpret the accuracy in recording anomalies by the dentists and how this information would help a forensic dentist. It is comprised of three...
Section 1 – Demographic information

Section 2 – The dental chart task

Fig. 2: Occlusal image of the upper and lower teeth. Only 3 dental surfaces considered: M = mesial; O = occlusal; D = distal

<table>
<thead>
<tr>
<th>No.</th>
<th>Question (examples)</th>
<th>Incorrect (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sound (no abnormality detected)</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Missing</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Pit and Fissure Caries</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Occlusal Caries</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>Mesial Caries</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>Distal Caries</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>Grossly Decayed</td>
<td>19</td>
</tr>
<tr>
<td>8</td>
<td>Occlusal filling</td>
<td>20</td>
</tr>
<tr>
<td>9</td>
<td>MOD filling</td>
<td>21</td>
</tr>
<tr>
<td>10</td>
<td>MO filling</td>
<td>22</td>
</tr>
<tr>
<td>11</td>
<td>DO filling</td>
<td>23</td>
</tr>
<tr>
<td>12</td>
<td>Metal Crown</td>
<td>24</td>
</tr>
</tbody>
</table>

Section 3 – Recording dental features

Question 1 - Do you record dental features that are not included in the patient’s chief complaint and that do not require treatment?

Question 2 - Is important to chart down every dental feature of a patient’s dentition?

Question 3 - Can dental features be used for human identification?

Question 4 - Can teeth be used as a primary source of identification of an individual?

Section 4 – Maintenance of dental records

Question 1 - Do you maintain the patient records/files in the institution/clinic/hospital you’re working for?

Question 2 - Which of the following records do you maintain along with the patient’s dental file? (You may select multiple answers).

Options: dental chart, photographs, radiographs, casts and none.

Question 3 - Do you believe that maintaining dental records/files can be forensically or medico-legally important?

Question 4 - Do you believe that there is need of more awareness on the forensic aspect of dentistry in India?

Fig. 3. Distribution of correct answers for anomalies of shape (Accessory cusp, Cup of Carabelli and Talon’s cusp) in percentage.

Fig. 4. Distribution of correct answers for anomalies of position (rotated tooth, midline diastema, crowding and transposition) in percentage.

parameters namely: Incorrect answer (0%; red color), Partially Correct answer (50%; yellow color) and Accurate answer (100%; green color). They classify different levels of forensic significance of dental findings in human identification as seen in Fig. 5.

In comparative dental analysis, the AM information of dental anomalies classified as “Accurate” would accurately aid in identification and thus, have high forensic significance. Information in the “Incorrect” category (considering other features in the dentition) would delay and jeopardize identification and thus would have low forensic significance. Recorded dental anomalies not specified by the scientific terminology would be part of the “Partially correct” category. This information would have moderate forensic significance because they would aid in the identification process but would require more time for interpretation (Fig. 5).

As an example, the accessory cusp on tooth 25 was mentioned only by 11.9% of the participants and 17.8% misnamed the anomaly as Talon’s cusp. This misinterpretation was considered partially correct (50%; yellow color) because the participants have acknowledged an additional cusp (which is correct and helps in identification) but have not used the correct scientific terminology. Other answers included sound, caries, occlusal filling, attrition, erosion, taurodont being considered incorrect answers (0%; red color) because those options are not additional cusps as seen in Fig. 6.

Sections 3 and 4

The incorrect results from the dental charting task contradicted the answers of 88% of the dentists that confirmed the recording of features that are not included in the patient’s chief complaint and do not require treatment. It was noteworthy to observe that more than 80 dentists considered it important to chart down every dental feature of a patient’s dentition. They also agreed that they can be used for human identification and that teeth can be used as a primary source of identification.

88% of the dentists maintain dental records, radiographs being the mostly maintained dental record, followed by dental charts, casts, and photographs. 97% considered the maintenance of dental records to be forensically or medico-legally important and 98% believe that more awareness is required in the field of Forensic Odontology in India. Although 2–3 dentists were unsure of the answers, there were no dentists disagreeing with the statements.

Discussion

With Preventive Dentistry and Dental Public Health gaining its popularity, many countries have established mobile dental clinics, conducted dental camps and dental outreach programs creating awareness, providing treatment and increasing access to dental care.
the absence of probing (as probing allows the tactile sensation of the dental and periodontal status of the oral cavity) could have jeopardized the clinical examination [25]. An example of neglect would be recording teeth that are missing as sound and vice versa. For example, recording teeth 13 and 23 as missing when they were transpositioned, and recording teeth 12 and 22 as sound when they were missing must be considered as a gross mistake when it comes to dental charting. Another reason for this incorrect recording could be the lack of attention. For example, this neglect could also happen in a dental clinic environment if the dentist is stressed or over-worked or easily distracted by too many patients waiting for treatment [26]. The misnaming of anomalies was also observed with a few responses. For example, the misnaming of the accessory cusp on tooth 25 as a talon’s cusp. This could be due to the gradual forgetting of terminologies of dental anomalies that are not commonly seen in the population they practice dentistry at in a monthly or yearly basis. Another reason could be, the participant not knowing the anomaly itself which in turn could also be a form of neglect [25,26].

The most overlooked findings were that of misalignment of teeth such as rotations, midline diastema, and crowding. This could be due to the patient’s attitude towards dental esthetics as it differs from one person to another based on age, sex, profession, and population. It was seen that young adults were more concerned about their dental esthetics than the elderly [27]. Similarly, women were more concerned about dental esthetics than men [28]. From a study on 94 dentists from four countries (Germany, the United Kingdom, China, and Switzerland) on how they would treat a dental anomaly, it was observed that the Chinese dentists recommended the most invasive treatment compared to dentists of other countries, proving that dental esthetics and the attitude towards the same is different not only among patients but also among dentists treating them [29]. It could also be due to the finance-driven attitude of dentists where they only chart findings that require a treatment, which in turn brings revenue and the anomalies that do not require treatment are ignored.

**Dental charting - the hidden truth**

This study demonstrates the alarmingly poor dental charting of dental anomalies by the respondents irrespective of the anomaly being...
inconspicuous or clearly visible. The charting of dental anomalies would help dental human identification mainly in cases where dental treatments are not present.

Psychology studies have shown that there is a social desirability bias when results of a survey are analysed as the respondent of a survey does not report/ reports lower rates of behaviors that they think is counter-normal (such as not recording every finding present in the oral cavity in this study) [30]. This is one of the reasons why the dental charting task was given to the dentists to test their recording pattern in actuality and not just depend on their answers to question 1 of the survey.

It was commendable to see that a majority of the dentists understand the role of dentistry in forensic sciences and how a single feature can be utilized for identification purposes of an individual. This awareness could be due to the increased popularity gained by the field of Forensic Odontology in India after the Delhi rape case in 2012 [31].

It was noteworthy to observe that majority of the dentists (89 out of 101) of the study maintained dental records. This has proved that the pattern of record maintenance has improved over the years when compared to other survey-based studies [12,20,21,24]. The most commonly maintained dental record was the radiographs which are considered to be the best kept AM record as it helps dental professionals to understand the outer as well as inner aspects of the teeth.

The awareness on forensic odontology and the importance of maintaining records for forensic and medico-legal aspects were exceptional as more than 90 % agreed on understanding the same. The awareness has significantly increased over the years when compared to other survey-based studies on Indian dentists [13,23,32]. This could also be due to its increasing popularity through media but the inadequate number of forensic odontologists practicing and teaching in India has caused a hindrance to the development of the subject in the country [33].

Dental records not only help in forensic and dental studies (as in cases of social profiling) but also help in geography-based population studies to understand the prevalence of an anomaly in a particular area (as in cases of fluorosis). It also helps in genetic studies to understand how certain anomalies are genetically inherited (for example, tooth agenesis, hyperdontia, etc). [34].

The solution

This study will help dentists and other dental professionals to realize how every single aspect of their dental charting and dental records can affect the decision of a forensic odontologist when it comes to forensic dental examination of an unidentified body. As a solution to help dental professionals identify and chart these dental anomalies, a digital “Atlas of Dental Anomalies” was created using a website-building platform on July 31 st, 2019. The website provides concise descriptions of localized dental anomalies on a set of permanent teeth. The atlas can act as a study material for dental students, a checklist for dental nurses, hygienists or assistants and/ or as reference material for practicing dentists when it comes to charting dental anomalies.

The digital atlas can be accessed at: http://www.theatlasofdentalanomalies.com/ through computers, laptops, and phones. Dental clinics with computers can have access to the atlas on their systems through the link provided and the dental clinics without computer access can use the printable PDF version of the atlas which can be downloaded as shown in Fig. 7. The PDF version features clinical presentation of various localized developmental and acquired dental anomalies. However, dental anomalies affecting the root or the pulp are only featured in the digital form of the atlas.

Fig. 7. The Atlas of Dental Anomalies (PDF version).
Conclusion

The awareness of Forensic odontology among the dentists was exceptional but the charting of dental anomalies was poor; therefore, an “Atlas of Dental Anomalies” and a “Scale of Forensic Significance of Dental Features” were designed to aid the charting of dental anomalies and to understand their forensic significance in human identification.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of Competing Interest

The authors declare no conflicts of interest.

Acknowledgements

Cordial thanks to Dr. Gavin Revie (Research Assistant in Statistics & Research Integrity Lead) for helping with the statistical analysis of the results, Mr. Karthik Manokaran (M.Sc Animation & VFX) for help with editing the images used for the survey and Ms. Angela Yeung (M.Sc Medical Art) for her selfless help in creating “The Atlas of Dental Anomalies”.

References