The credibility of dental pulp in human blood group identification

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Abstract

Background: The identification of unknown individual has always been of paramount importance to the society. Blood groups are excellent aids to these pursuits. Dental tissue acts beneficial because tooth is the hardest of all human tissues, and they can be preserved intact for a long period of time after the death of the individual. Hence, this study is conducted to evaluate the role of dental pulp in identification of human blood group. **Aim:** To determine the ABO blood grouping from the pulpal tissue of an extracted tooth and to correlate the same with blood group details obtained from the study subjects. **Materials and Methods:** This is a double-blinded randomized controlled trial conducted on a sample of thirty extracted teeth. The teeth were stored dry for 2 months. An attempt to establish the blood group from pulp was made by absorption-elution method. The collected data were coded, and statistical analysis was carried out using Statistical Package of Social Science (SPSS Version 20). Cronbach's alpha was applied to check the reliability of the absorption-elusion method in the detection of blood group from dental pulp. **Results:** Blood groups obtained from the pulp were compared with those obtained from the study subjects. Blood group establishment from dental pulp using absorption-elusion method had a good internal consistency in comparison with the conventional Karl Landsteiner's blood typing method. This study showed that pulp tissue is a reliable method to detect blood groups of individuals. **Conclusion:** It can be concluded that dental pulp can be used to establish identity, where teeth happen to be the only remnants available for personal identification.

Key words: ABO blood grouping, absorption-elusion method, dental pulp, teeth

Introduction

Disasters are events that are often unexpected with damages of unexpected magnitudes.[1] The world has experienced a plethora of mass disasters in recent years: Acts of terrorism, bombings, earthquakes, hurricanes, typhoons, air crashes and other transportation mishaps, not to mention armed conflicts and migrants drowned in the Mediterranean Sea.[2] Disaster response and management has always been one of the biggest challenges to a community. Disasters, especially man made cannot be predicted, but they frequently result in injuries and deaths of large numbers

of people.[1] In reviewing mass disasters to date, the principal difficulties may include large numbers of humans fragmented, co-mingled, and burned remains, difficulty in determining who was involved in the disaster, acquisition of useful medical and dental records and radiographs, legal, jurisdictional, organizational, and political issues, internal and external documentation and communication problems, and application of universal human forensic identification codes.[2,3]

Victim identification plays an important role after any disaster. Disaster victim identification (DVI) after disasters encompasses all the methods and the procedures used in the identification of deceased victims in events of mass disaster. In situations of mass fatalities, experts from several specialties are called in to assist in the quick identification and faster return of human remains of the deceased to their respective relatives.[1] Forensic dentistry plays a major role in victim identification. It is a part of a suite of techniques used to identify mass disaster victims. Forensic odontology is one of three primary identifiers designated by Interpol to identify victims of mass casualty events.[4,5]

Teeth, by their very nature, are preserved through many physically damaging events and therefore can play an important role as remains for identification as they are resistant in nature.[1] Hence, this study was conducted to evaluate the role of dental pulp in the identification of human blood group. The aim of the present study was to determine the ABO blood grouping from the pulpal tissue of extracted teeth and to correlate the same with blood group details obtained from the study subjects.

Materials and Methods

Study design and study setting
This study was a double-blinded randomized control trial conducted at the Centre for Scientific Research and Development, People's University, Bhopal. Ethical clearance was obtained from the Institutional Ethical Committee of People's Dental Academy, Bhopal. Permissions for conducting this study was obtained from The Director, Centre for Scientific Research and Development, People's University, Bhopal, and the study has been reported and registration application has been initiated with the Consort 2010 Statement.

Source of data and sample size
Source of data was the extracted teeth from the Department of Public Health Dentistry, People's Dental Academy, People's University, Bhopal, and total sample included thirty extracted teeth. Informed consent was obtained from patients before their tooth extraction and attaining their blood group details.

Inclusion and exclusion criteria
Intact teeth with vital pulp were included in the study and carious teeth which were nonvital were excluded from the study.

Data collection
The teeth were extracted by a third person, and during the time of extraction, the demographic details and blood groups were obtained from the patients themselves. The investigator and the statistician were blinded regarding the blood group of the individual. The extracted teeth were washed under running water, and debris was removed with the probe, and wiped with gauze, and kept in numbered bottles. They were stored dry for 2 months (to achieve the cause of mass disaster circumstances). Establishment of the blood group from pulp was made by absorption–elution method.

Absorption-elusion method
Modeling wax was folded and made into a block. Tooth was embedded in the modeling wax block. Tooth (both crown and root) was split longitudinally using a carborundum disk at 30,000 rpm. Pulp was removed with sterile curette/spoon excavator and kept dry in a sterile test tube. The pulp was then divided in to three parts and placed into three test tubes. To each test tube, antiserum A, B, D (three drops) were added, respectively. Antiserum was soaked for 2½ h at room temperature, and then later removed and sample washed three times with cold saline solution (centrifuged and supernatant was sucked with pipette). Two drops of fresh saline were added and heated in water bath at 56°C for 10 min. A drop of 0.5% A/B group red cell suspension was placed into each test tube and incubated at 37°C for 30 min. It was then centrifuged at 1500–2000 rpm for 1 min and viewed under microscope at magnification of ×100 for the presence of flocculation. This pulpal blood group was matched with capillary blood group.

The collected data were coded, and statistical analysis was carried out using Statistical Package of Social Science (SPSS Version 20). Cronbach's alpha was applied to check the reliability of the absorption-elusion method in the detection of blood group from dental pulp.

Results

Blood groups obtained from the pulp were compared with those obtained from the study subjects. Out of the total sample of 30 extracted teeth, 16 were of males and 14 were of females.

Sensitivity of blood groups among the study samples [Table 1] which were documented from the study subjects and those verified by absorption-elusion method illustrated that out of total study sample, 24 teeth showed

positive results for ABO blood group from dental pulp and 6 showed negative results. Hence, the sensitivity (ability to measure) of pulp in establishment of blood group was found to be 80%.

Cronbach's alpha was used to measure the internal consistency of the procedure. Reliability estimate of ABO blood grouping from dental pulp using Cronbach's alpha was found to be 0.858, suggesting that blood group establishment from dental pulp using absorption-elusion method had a good internal consistency in comparison with the conventional Karl Landsteiner's blood typing method.

Discussion

The present study was conducted to evaluate the credibility of dental pulp in human blood group identification. In this study, it was observed that the sensitivity of pulp in determining blood groups was 80%. This was in accordance with the study conducted by Shetty and Premalatha in which ABO blood grouping was conducted from tooth material and they suggested that sensitivity of pulp in determining blood grouping is significantly high (96.7%) even after storing dry for 6 months.[8] Ballal and David in their study to determine ABO blood grouping from dentine and pulp showed a statistically significant positive results (90%) in determining ABO blood groups from dental pulp which is in unison with the present study.[9] This level of high sensitivity can be attributed to the very nature of teeth being preserved through many physically damaging events and hence serving as an effective tool in provision of pulpal tissues. Another study by Ramnarayan *et al.* also showed similar results in which ABO blood grouping from hard and soft tissues of teeth by modified absorption-elution technique showed a very high sensitivity of dental pulp in both fresh and long-standing teeth (83.3%).[10]

Review on the use of dental pulp in identification of blood group of deceased human by Karthika and Elumalai

suggested that pulpal tissue from teeth can be used for blood grouping and is considered as a hallmark for identification of biological material in forensic investigation, which can be ascribed from the present study.[7] Berketa *et al.* evaluated forensic odontology involvement in DVI and was of the opinion that forensic odontology is one of the three primary identifiers designated by Interpol to identify victims of mass casualty events which can be comprehended from the present study.[4]

Hinchliffe in his paper emphasized the need for an efficient and sensitive response to assist in the identification of victims of mass fatality incidents and the necessity for trained team responses which can be corroborated from the present study where evidence is given regarding the efficient use of dental tissue in victim identification. Hence, dental team should be sufficiently trained for such responses.[11]

Nathan and Sakthi in their review on dentistry and mass disasters opined that various roles of dentists in mass disaster management includes the use of forensic dental techniques and the resulting positive impacts made on human identification.[12] The importance of preparation by way of special training for the dental personnel, mass disaster rehearsal, and use of modern day technology has to be stressed on, and this can be substantiated from the present study. Kolude *et al.* emphasized in their review that the varying extent of use of forensic dental techniques and the resulting positive impact on human identification should include special training for forensic dental personnel, mock disaster rehearsal, use of modern day technology, and the need for international standardization of identification through the use of Interpol DVI forms. The present study also demonstrates that these methods can enhance the use of forensic dentistry in mass fatalities.[13]

In the present study, it was established that the dental pulp contributed resourcefully to the establishment of blood group of individuals which in turn enables the identification of the individuals. The distinctive character of teeth as one of the most long lasting integral remnants of the human body enables its successful use in forensic sciences. Pretty and Sweet in their document on a look at forensic dentistry: The role of teeth in the determination of human identity commended that forensic dentistry plays a major role in the identification of those individuals who cannot be identified visually or by other means. The unique nature of our dental anatomy ensures accuracy when the techniques are correctly employed.[14] Ishwar *et al.* in their case study of Uttarakhand disaster victims harangued that for the proper identification of victims, the Government of India should frame the policy to adopt the primary scientific methods such as fingerprint analysis, comparative dental analysis, and blood group analysis from dental tissues and DNA

Table 1: Sensitivity of blood groups among the study samples

Blood groups	Blood group documented	Blood group verified
A		
+ve	9	7
−ve	2	3
B		
+ve	6	5
−ve	3	4
AB		
+ve	2	2
−ve	1	1
O		
+ve	3	3
−ve	1	2
Total	30	30

Sensitivity of pulp in blood group establishment=24/30=80%

fingerprinting and to in co-operate the international system of identification. Furthermore, policy should be framed to imply the forensic experts team (forensic medical expert, anthropologist, fingerprint expert, and odontologist) in such situations with proper training and drills to promote higher percentage of identifications.[15]

Limitations of this study can be attributed to the fact that tooth with obliterated canals and regressive alterations do not provide sufficient pulpal tissue. This is also a time consuming procedure and costly. Moreover, the fresh red cell suspension has to be prepared every day to produce more accurate results.

Conclusion

Blood grouping from tooth pulp might be of great help in identification even after storing for relatively long periods. ABO blood groups obtained from dental pulp can be used to establish identity, where teeth happen to be the only remnants available for personal identification especially as in mass disasters.

Hence, it can be recommended that the uniqueness of teeth as being one of the hardest structures of the human body which remain intact for very long periods of time enable teeth to act as a powerful tool in victim identification in mass disasters. Hence, it should be considered a priority to train dentists regarding disaster management techniques.

Conflicts of interest
There are no conflicts of interest.

References

1. Rajshekhar M, Tennant M. The role of the forensic odontologist in disaster victim identification: A brief review. Malays J Forensic Sci 2013;5:78-85.
2. Nuzzolese E, Di Vella G. Future project concerning mass disaster management: A forensic odontology prospectus. Int Dent J 2007;57:261-6.
3. George D, Mallery P. SPSS for Windows Step by Step: A Simple Guide and Reference. 4th ed. Boston: Allyn & Bacon; 2003.
4. Berketa JW, James H, Lake AW. Forensic odontology involvement in disaster victim identification. Forensic Sci Med Pathol 2012;8:148-56.
5. Gambhir RS, Kapoor D, Singh G, Sawhney G, Setia S. Disaster management: Role of dental professionals. Int J Med Sci Public Health 2013;2:424-9.
6. Veeraraghavan G, Lingappa A, Shankara SP, Mamatha GP, Sebastian BT, Mujib A. Determination of sex from tooth pulp tissue. Libyan J Med 2010;5:5084.
7. Karthika B, Elumalai M. Identity of blood group from dental pulp of deceased human. Int J Pharm Bio Sci 2013;4:1000-4.
8. Shetty M, Premalatha K. ABO blood grouping from tooth material. J Indian Acad Forensic Med 2010;32:336-8.
9. Ballal S, David MB. Determination of ABO blood grouping from dentine and pulp. Pak Oral Dent J 2011;31:3-6.
10. Ramnarayan B, Manjunath M, Joshi AA. ABO blood grouping from hard and soft tissues of teeth by modified absorption-elution technique. J Forensic Dent Sci 2013;5:28-34.
11. Hinchliffe J. Forensic odontology, part 2. Major disasters. Br Dent J 2011;210:269-74.
12. Nathan MD, Sakthi DS. Dentistry and mass disaster – A review. J Clin Diagn Res 2014;8:ZE01-3.
13. Kolude B, Adeyemi BF, Taiwo JO, Sigbeku OF, Eze UO. The role of forensic dentist following mass disaster. Ann Ib Postgrad Med 2010;8:111-7.
14. Pretty IA, Sweet D. A look at forensic dentistry – Part 1: The role of teeth in the determination of human identity. Br Dent J 2001;190:359-66.
15. Ishwar T, Malik PP, Mohammad I, Maneel G, Chandra P. Uttarakhand disaster: Status of disaster victim identification in India. Austin J Forensic Sci Criminol 2014;1:1-4.