ORIGINAL RESEARCH

Pulp tissue in gender determination- A forensic Study

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ABSTRACT

Background: Teeth can survive and remain virtually unaffected long after other soft tissue and skeletal tissues have been destroyed. The present study was conducted to assess pulp tissue in gender determination. **Materials & Methods:** 30 periodontally or endodontically extracted premolar teeth of both genders were further categorized into 5 groups of 6 each (3 from males and 3 from females) based on the extent of caries progression. Group I includes freshly extracted tooth specimens with no caries, group II consisted of tooth specimens with caries in enamel, group III comprised of tooth specimens with caries less than half way of dentin, group IV consisted of freshly extracted teeth with caries more than half way of dentin, and group V includes freshly extracted tooth specimen with caries involving pulp. The pulp cells are stained with quinacrine hydrochloride and observed with fluorescent microscope for fluorescent body. Gender was determined by identification of Y chromosome fluorescence in dental pulp. **Results:** Efficiency of diagnostic utility of fluorescent body in identifying gender in group I was 100%, in group II was 100%, in group III was 80%, in group IV was 50% and in group V was 45%. The percentage of fluorescent bodies in males and females in group I was 70.4 and in group II was 4.7, in group II was 64.2 and 5.3, in group III was 40.5 and 18.5, in group IV was 22.6 and 16.4 and in group V was 10.2 and 12.9 respectively. **Conclusion:** When determining the sex of a tooth with healthy pulp tissue, caries with enamel or dentin up to half of its length, fluorescence staining of the Y chromosome is a dependable method. Teeth with pulp-related caries cannot be used to determine a person's sex.

Keywords: Teeth, gender, forensics

INTRODUCTION

The four primary components of biological identity—also referred to as the "Big Four" in forensic contexts—are an individual's sex, age, size, and ethnic heritage.[1]

Identification of individuals is crucial for humanitarian and legal reasons alike. Even with the enormous advances in forensic medicine, this practical issue still exists.[2] Since body circumstances are unavailable for other methods (like fingerprints), the use of dental identification has long been regarded as a dependable technique. As a result, forensic odontology has developed into a whole branch throughout time.[3]

Teeth can survive and remain virtually unaffected long after other soft tissue and skeletal tissues have been destroyed.[4] The recognition of teeth as a tissue that withstands great variation in environment has led to its application in personal identification. Tooth pulp is encased in a hard tissue casting, where it may be protected from detrimental effects of impact, trauma, and heat.[5] Although a number of metrics have been put up to determine an individual's sex from their teeth, none of them have shown to be reliable. Although DNA analysis in forensics has become more popular recently, it is costly and time-consuming. This led us to search for more trustworthy and affordable dental identification techniques.[6] The present study was conducted to assess pulp tissue in gender determination.

MATERIALS & METHODS

The present study was conducted on 30 periodontally or endodontically extracted premolar teeth of both genders.

Data such as name, age, gender etc. was recorded. Study sample consisted of 15 male and 15 female teeth, which were further categorized into 5 groups of 6 each (3 from males and 3 from females) based on the extent of caries progression. Group I includes freshly extracted tooth specimens with no caries, group II consisted of tooth specimens with caries in enamel, group III comprised of tooth specimens with caries less than half way of dentin, group IV consisted

of freshly extracted teeth with caries more than half way of dentin, and group V includes freshly extracted tooth specimen with caries involving pulp. The pulp cells are stained with quinacrine hydrochloride and observed with fluorescent microscope for fluorescent body. Gender was determined by identification of Y chromosome fluorescence in dental pulp. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Diagnostic utility of fluorescent body in identifying gender

Groups	Sensitivity	Specificity	PPV (%)	NPV (%)	Efficiency
I	100	100	100	100	100
II	100	100	100	100	100
III	70	85	80	80	80
IV	25	70	35	60	50
V	20	50	25	40	45

Table I, graph I shows that efficiency of diagnostic utility of fluorescent body in identifying gender in group I was 100%, in group II was 100%, in group III was 80%, in group IV was 50% and in group V was 45%. The difference was significant (P< 0.05).

Graph I Diagnostic utility of fluorescent body in identifying gender

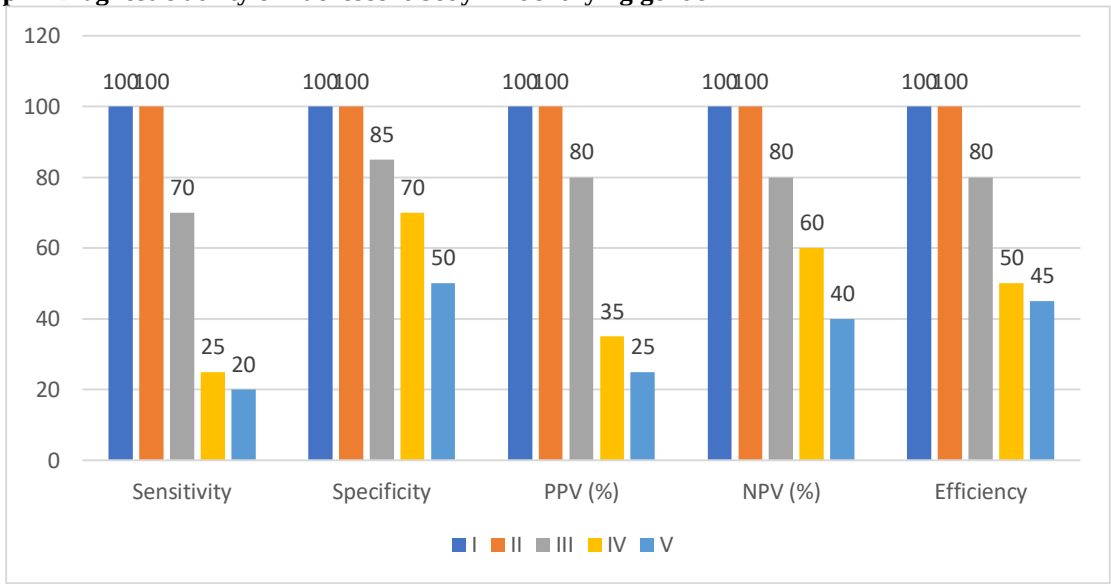

Table II Assessment of percentage of fluorescent bodies

Groups	Males	Females	P value
I	70.4	4.7	0.01
II	64.2	5.3	0.02
III	40.5	18.5	0.04
IV	22.6	16.4	0.14
V	10.2	12.9	0.23

Table II shows that percentage of fluorescent bodies in males and females in group I was 70.4 and in group II was 4.7, in group II was 64.2 and 5.3, in group III was 40.5 and 18.5, in group IV was 22.6 and 16.4 and in group V was 10.2 and 12.9 respectively. The difference was significant (P< 0.05).

DISCUSSION

In forensic medicine, determining a person's gender is regarded as the first and most crucial stage in the identification process.[7,8] Simple identification in the living, where a person of one sex bears the features of the other, determining a person's ability to exercise certain civil rights reserved for only one sex, resolving issues with legitimacy, divorce, paternity, and affiliation with certain criminal offenses, and identifying a deceased person in straightforward situations where primary sex organs are lost due to decomposition are all instances where it is important.[9,10] The different techniques used to identify sex in FO include rugoscopy in conjunction with molecular techniques based on the examination of nuclear and mitochondrial DNA, as well as sexual dimorphism of canine teeth. Anthropological techniques can also be used to establish sex based on the morphological features of the bones.[11]

We found that efficiency of diagnostic utility of fluorescent body in identifying gender in group I was 100%, in group II was 100%, in group III was 80%, in group IV was 50% and in group V was 45%. Nayar et al[12] determined and compared the reliability of pulp tissue in determination of sex and to analyzed whether caries have any effect on fluorescent body test. This study was carried on 50 maxillary and mandibular teeth (25 male teeth and 25 female teeth), which were indicated for extraction. The teeth are categorized into 5 groups, 10 each (5 from males and 5 from females) on the basis of caries progression. The pulp cells are stained with quinacrine hydrochloride and observed with fluorescent microscope for fluorescent body. Fluorescent bodies were found to be more in sound teeth in males as the caries increase the mean percentage of fluorescent bodies observed decreases in males. They also observed the fluorescent spots in females, and the value of the spot increases in female as the caries progresses, thereby giving false positive results in females.

We found that percentage of fluorescent bodies in males and females in group I was 70.4 and in group II was 4.7, in group II was 64.2 and 5.3, in group III was 40.5 and 18.5, in group IV was 22.6 and 16.4 and in group V was 10.2 and 12.9 respectively. Veeraraghavan G et al[13] determined the reliability of sex determination from teeth pulp tissue. This study was carried on 60 maxillary and mandibular premolars and permanent molars (30 male teeth and 30 female teeth) which were indicated for extraction. The teeth were categorized into three groups of 20 each (10 from males and 10 from females). Group 1- pulp tissue from teeth examined immediately after extraction. Group 2- and Group 3-pulp tissue examined from teeth one and five month after extraction, respectively. Teeth was sectioned and pulpal cells were stained with quinacrine dihydrochloride. The cells were observed with fluorescent microscope for fluorescent body. Gender was determined by identification of Y chromosome fluorescence in dental pulp. Freshly extracted teeth and for those examined one month later, sensitivity, specificity, positive predictive value, negative predictive value, and efficiency were all 100%. The fluorescent Y body test is shown to be a reliable, simple, and cost-effective technique for gender identification in the immediate postmortem period up to one month.

Khanna et al[14] evaluated the time period till which sex can be determined from pulp tissue using three stains H and E, Feulgen, and acridine - orange under fluorescence. 90 pulp samples (45 males and 45 females) were subjected to Barr body analysis for determination of sex using light and fluorescent microscopy. Barr body was found to be positive for female samples and negative or rare in the male sample (<3%). Barr body from human dental pulp tissue can be used as a successful determinant of sex identification in FO.

The shortcoming of the study is small sample size.

CONCLUSION

Authors found that when determining the sex of a tooth with healthy pulp tissue, caries with enamel or dentin up to half of its length, fluorescence staining of the Y chromosome is a dependable method. Teeth with pulp-related caries cannot be used to determine a person's sex.

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