Smile Photographs as a Tool for Forensic Identification

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Abstract :

The execution of forensic odontology technique for human identification depends on the existence of dental files produced ante – mortem. However, when these are not present, other sources of dental data should be searched, such as photographs of the smile. This study executes human identification through the analysis of photographs of the smile based on dental parameters. The justification for this alternative investigation is based on the search of data on shape, dimensions and alignment of the teeth of a person, which can compromise a unique and specific site. Considering that in the analysis of bodies so – called "unrecognizable" the forensic odontology techniques superimposes the other methodologies – because of their lower operational cost, faster analysis and data interpretation, higher reliability of the results obtained and the presence of qualified professionals – it becomes essential that new parameters be either developed or obtained, aiming to evidence and identify as unique the dental features of each individual.

Keywords: Smile Photographs, Human Identification.

Introduction

In the traditional forensic odontology practices dental files and records[1,2] provide a safe data source for ante and post – mortem comparisons. But these records sometime may be inappropriate for several reasons like extensive destruction of facial complex, lack of records obtained for clinical purpose or records with irrelevant forensic information.

Considering that in the analysis of unrecognizable bodies the forensic odontology techniques superposes the other methodologies because of their lower operational cost, higher reliability of the results obtained and the presence of qualified professionals. So there comes the need to establish new parameters aiming to evidence and identify unique dental features of each individual.

So nowadays, forensic experts acting in practice of human identification search for information in alternative sources, such as photographs of face,[3] shootings[4] or photographs of smile, which exhibit specific characteristics of each subject. The justification for this alternative investigation is based on search of data on shape, dimensions and alignment of teeth of a person, which can be a unique and specific set.

Hence the present study was aimed to demonstrate the importance and applicability of photographs of the smile as information source for human identification, through the comparative analysis to correlate photographs

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of smile to intraoral photographs and to identify parameters which would be more recurrent for establishing positive forensic identification by using photographs.

Methodology

A study was conducted in the department of oral medicine and radiology at ITS-CDSR Muradnagar, Ghaziabad. A total of 40 patients were taken from those visiting the department of oral medicine and radiology in the months of May- June 2014. Out of 40 patients 20 patients had undergone orthodontic treatment and rest 20 are patients without orthodontic treatment. Patients were informed prior to the beginning of the study and a written consent form was obtained. Ethical clearance was taken from institutional ethical committee. Proper dental and medical history was recorded; thorough clinical examination was done for each patient.

Study was divided into two stages:

Stage 1 – in which collection of data and images (intra oral and smile photographs were done); Stage 2 – analysis of the images obtained.

Stage 1:

Individuals without orthodontic appliance on the labial surfaces of the anterior teeth and the possibility of visualization of the anterior teeth inside the area of the exposition of the smile were included in the study. Smiles that did not show the incisal edge of the maxillary anterior teeth and the presence of diastemas between the maxillary central incisors, traumatized, discolored anterior teeth were excluded from the study.

For every individual, types of photographs produced included: a smile and an intraoral, which resulted in 20 pairs of photographic images for each group.

To obtain photograph of smile, all face of individual was framed in frontal norm: individuals were asked to exhibit a forced or social smile, so that incisal edges of all the anterior teeth could be seen. These photographs were performed with tripod and conventional digital camera (Sony Cybershot, DSC W210, 12.1 megapixels), with 3.0 megapixel of resolution. Individual was placed in seated position on a chair at 1.5 m far from lens, with Frankfurt plane parallel to floor. Photograph was cut using Adobe Photoshop software version 7.0, resulting in image of area between infraorbital margin and chin.

To obtain intraoral photograph, participant was photographed at lying position on a dental chair with dental reflector turned off. Lips were manually separated, so that incisal edges of maxillary and mandibular teeth could be seen. Photographic record was carried out with semiprofessional camera (Nikon Coolpix 7800, 8 megapixels), with 3.0 megapixels of resolution.

To stimulate probable forensic odontology identification, smile photographs were considered as standard images, that is produced during life (ante mortem), and intraoral photographs were considered as question images, that is they would have been produced after death (postmortem).

Stage 2:

Second stage of research comprised a voluntary participation of 3 Oral Medicine and Radiology postgraduate students. This group of 3 students stimulated action of a forensic odontology expert in two situations:

Identification of one missing person when there are 10 non identified bodies, through using smile photograph [Fig 1 & 2]

Identification of one non identified body when there are 10 non identified bodies.

At this stage, participants were informed that either smile or intraoral image that should be analyzed had its correspondent pair necessarily present within photographic set, stimulating the situation which occurs in closed events, that is when the list of missing people is known.

To make test viable, four different types of tests were created by dividing the images as:

A. 1 smile and 10 intraoral images in the group without orthodontic treatment

B. 1 intraoral and 10 smile images in the group without orthodontic treatment

C. 1 intraoral & 10 smile images in the group submitted to orthodontic treatment

D. 1 smile & 10 intraoral images in the group submitted to orthodontic treatment

Image displayed in each set were numbered from 1 to 10; then a number was drawn which enabled the search for its correspondent image, which was recorded on an answer sheet. Each 1 of the 3 participants of this stage performed 4 tests, comprising a total time period of 20 minutes (5 minutes for each test).

Following to the comparative analysis, participant should mark on answer sheet: number of photograph of set correspondent to image analyzed and type of particularity which based the final conclusion, whose criteria should be visualized in both photographs.

Statistics

For statistical analysis, Fisher's exact test was applied, comparing the performance of the the postgraduates in positively correlating intraoral with extra oral photographs.

Results

Tests B and D showed 91.6% of right answers among the postgraduate students.

Most relevant parameters pointed out by the postgraduate students to reach the positive identification through the smile photographs were - incisal alignment, crowding, lack of teeth (agenesis, etc.), colour, midline deviation, diastemas, wearing of surfaces, composite veneers, crown fractures, giroversions, tooth inclination,crown morphology of tooth # 11/21, 12/22, 13/23, morphology of the incisal edges, morphology of the mandibular anterior teeth, ratio between the crown dimensions of the maxillary central and lateral incisors, composite restorations.

In test A; morphology of crowns of maxillary central incisors (83.3%) and morphology of incisal edges of anterior teeth (75%) were used by postgraduate students.

In test B; postgraduate students used morphology of maxillary lateral incisors (66.6%) and morphology of incisal edges of anterior teeth (66.6%).

In test C; postgraduates used incisal edges morphology (83.36%) and color of anterior teeth (83.36%).

In test D; postgraduates used crown morphology of teeth 11 and 21 (75%) andmorphology of incisal edges of anterior teeth (66.6%).

Discussion

Forensic dentistry identification through photographs of smile aims to comparative analysis between ante mortem and postmortem features of individuals who for any reason do not have their identity established through fingerprint analysis. It is worth highlighting that if on one hand, identification through smile photographs is difficult because of orthodontic treatment; on other hand, this type of treatment makes easy classical forensic odontology identification

because of presence of orthodontic files of individual, comprising radiographs, photographs and dental casts.

It was possible to observe that the right answer rate for 4 tests was high (95.8%); only 2 identification errors occurred. This showed that all postgraduate students were technically prepared to execute human identification through smile photographs of people who had been or had been not submitted to orthodontic treatment.

In test B, only 1 postgraduate participant did not answer right (97.9%), demonstrating that lack of orthodontic treatment enabled identification of dental features that were not therapeutically corrected (misalignments, crowding, etc.).[7] In tests C and D, 1 error occurred (6.3%) within 06 identifications, evidencing that analysis of photographs of individuals already submitted to orthodontic treatment had a higher difficulty rate than that of individuals without orthodontic treatment.

It emphasized the importance of morphological variations in the incisal edges of the anterior teeth, mainly in the maxillary central and lateral incisor crowns, which tend to be a single and specific set of dental features within the smile of each individual.[6,7] Accordingly, to classify the maxillary central incisors regarding to their shape (square, triangle and ovoid)[6] is an important stage to start to include or exclude the individuals for the analysis of the smile photographs.

The incisal alignment or line is frequently analyzed during either the orthodontic clinical practice or the planning of aesthetical tooth interventions.[8,9] Notwithstanding, this parameter may constitute an important element in evidencing a set of specific dental features, through using specific software for image editing, as Adobe Photoshop®.

Identification of individual dental features in images produced ante- and post-mortem cannot be simply faced, because all data set should be properly described, evidenced, and discussed on forensic report so that this document could constitute the fundamental tool for establishing a positive correlation between a missing person and a non-identified body. In this sense, forensic odontology expert is the professional who has the best post-graduation level to interpret the dental vestiges and exhibit them efficiently to the Justice.

Conclusion

Considering the great amount of dental features that can be potentially found in anterior teeth (anatomic, functional, pathological, traumatic or therapeutical), the smile photographs can be considered as an adequate information source to establish a positive forensic odontology identification. The postgraduate student demonstrated technical capacity to analyze the smile photographs aiming to human identification in a direct analysis of comparison.

Fig. 1A

Fig. 1B : Test A: Smile photograph (A) and set of intraoral photographs (B), without orthodontic treatment

Fig. 2A

Fig. 2B : Test D: Smile photograph (A) and set of intraoral photographs (B), with orthodontic treatment

Table I – Right answer rate of postgraduates for each one of the tests applied (n = 3)

Test	Postgraduates (%)
A	100
B	91.6
C	100
D	91.6

Table II – Number of times that each inclusion criterion was pointed out by the participants for each test type (n = 3)

	A	B	C	D	Total
Incisal alignment	4	5	4	7	20
Crowding	1	6	1	-	8
Lack of teeth (agenesis, etc.)	-	-	1	-	1
Colour	3	5	10	3	21
Midline deviation	-	-	-	-	-
Diastemas	-	-	-	-	-
Wearing of surfaces	6	4	5	1	16
Composite veneers	-	-	1	-	1
Crown fractures	1	3	5	-	9
Giroversions	2	4	1	-	7
Tooth inclination	2	2	2	2	8
Crown morphology of tooth # 11/21, 12/22, 13/23	10	5	4	9	28
Morphology of the incisal edges	4	8	7	6	25
Morphology of the mandibular anterior teeth	7	5	-	2	14
Ratio between the crown dimensions of the maxillary central and lateral incisors	9	8	10	8	35
Composite restorations	1	-	-	-	1

Test A – without orthodontic treatment/smile image x intraoral photograph set; test B – without orthodontic treatment / intraoral image x smile photograph set; test C – with orthodontic treatment/ intraoral image x smile photograph set; test D – with orthodontic treatment / smile image x intraoral photograph set

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