

Training module for cheiloscopy and palatoscopy in forensic odontology

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Abstract

Introduction: Studies of lip prints and palatal rugae, dates back to late 19th and early 20th centuries and since then, various methods of classification and analysis were introduced, however systematic recording and analysis of data is still need to improve further, to arrive at flawless and meaningful conclusions. Moreover, the awareness among dental personnel regarding the practical knowledge of cheiloscopy and palatoscopy is ambiguous. So, efforts have been made to introduce training module to improve the education of cheiloscopy and palatoscopy for dental students. **Aims and Objective:** 1. To prepare training module for cheiloscopy and palatoscopy. 2. To assess the efficacy of designed training module. **Materials and Methods:** Training module was used to train the dental students. Random matching of lip and palatal rugae patterns was carried out by dental students before and after training. Pre- and post-training matched results were then compared. Intraobserver variability assessed by comparing first and second assessment of lip print and palatal rugae patterns. **Results:** It was inferred statistically that training module had improved the ability to identify individuals based on lip prints and palatal rugae, with insignificant intraobserver variation.


Key words: Lip print, palatal rugae, training module

Introduction

Identification of any individual-living or dead-is based on the theory that all individuals are unique.^[1] More unique the characteristic of an individual, easier would be the identification. Lip prints and palatal rugae patterns are considered to be unique for an individual and hence hold the potential for identification.^[2,3] Nowadays, lip prints and palatal rugae has been subject of great interest to most researchers, it being the noninvasive and easily available mode for study purpose in human identification.

Although studies of lip prints and palatal rugae, dates back to late 19th and early 20th centuries and since then, many investigators from time to time have introduced various methods of classification and analysis, however systematic recording and analysis of data is still need to improve further, so as to arrive at flawless and meaningful conclusions.

The formal training in forensic odontology and its inclusion in dental curricula, was recognised and acted on in the 1960s and 1970s; however, the first course in forensic dentistry was probably conducted by Prof. Sadanori Mita of Japan as early as 1903.^[4] Although, Forensic Odontology has been included as one of the unit in undergraduate dental curriculum; however, the awareness among dental personnel regarding the practical knowledge of cheiloscopy and palatoscopy that play wondrous role in forensic investigations is ambiguous. With this thought, efforts have been made to introduce training module to improve the education of cheiloscopy and palatoscopy for dental students in a simplified manner.

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Materials and Methods

Training module for cheiloscopy and palatoscopy is comprised of:

Lip print patterns

Twenty set of lip print patterns along with their corresponding clinical photographs (using Sony Cybershot, 7.2 MPx) were obtained on bond paper fixed with cardboard using dark coloured lipstick, following guidelines given by Bindal *et al.*,(2009).^[5] Numerical coding of photographs and patterns was done [Figures 1 and 2].

Palatal rugae patterns

Twenty set of palatal rugae patterns in the form of maxillary casts along with their corresponding clinical photographs (using Sony Cybershot, 7.2 MPx) were obtained using alginate impression material, dental stone, and plaster of Paris. The outline of the rugae were traced

on casts using a sharp pencil.^[6] Teeth and vestibular region of cast were trimmed, to ensure that the teeth and vestibule would not have any influence while identification.^[7] Numerical coding was done [Figures 3 and 4].

Record sheet for cheiloscopy

Record sheet for cheiloscopy was prepared based on method described by Augustine *et al.*,(2008)^[8] following Suzuki and Tsuchihashi classification (1970):

Classification Groove type

- Type I Complete vertical
- Type I Incomplete vertical
- Type II Branched
- Type III Intersected
- Type IV Reticular
- Type V Irregular.

The record sheet for cheiloscopy is composed of charting designed in the form of schematic outline of lip, which is divided into four quadrants and each quadrant into medial and lateral half further. This charting is meant to register lip patterns observed in various segments.^[8] Also, pictorial description of various patterns have been added as a guide to the examiner [Figures 5 and 6].



Figure 1: Method to obtain lip print-using dark coloured lipstick lip prints were obtained on bond sheets from the volunteers



Figure 2: Lip print obtained on bond sheet- three consecutive lip prints were obtained on bond sheets



Figure 3: Making alginate impression of maxilla-at semi supine position irreversible hydrocolloid maxillary impression (alginate) was made of volunteers



Figure 4: Maxillary cast obtained-maxillary alginate impression was poured in dental stone and a definite cast was obtained. Teeth and vestibular region were trimmed and base was prepared using plaster of Paris. Palatal rugae were outlined using lead pencil

Record sheet for palatoscopy

Record sheet for palatoscopy was prepared based on method described by Venegas *et al.*, (2009)^[9] following Trobo classification (1932):

Classification Rugae type

- Type A Point
- Type B Line
- Type C Curve
- Type D Angle
- Type E Sinuous
- Type F Circle.

Record sheet for palatoscopy is designed in tabular form which is compartmented for registering shape of palatal arch and shape, location, and number of rugae.

Recording chart as well as examining palate is divided into right and left halves and in five zones: Zone I-II, II-III, III-IV, IV-V, and V-VI; compartmentalized by six transverse planes^[9]

- Transverse line passing through the palatal cervical third of the central incisors
- Transverse line that goes from the mesial side of the

right lateral incisor to the mesial side of the left lateral incisor

- Transverse line through the mesial side of the right canine and reaches to the mesial side of the left canine.
- Transverse line through the mesial side of the right first premolar and reaching to the mesial side of the left first premolar
- Transverse line through the mesial side of the right second premolar and reaching to the mesial side of the left second premolar
- Transverse line through the distal side of the second premolar and reaching to the right side of the distal left second premolar [Figures 7 and 8].

Above described training module was used to train 10 dental students, including Bachelor of Dental Surgery (BDS) II, III, IV, interns, and postgraduate (PG) dental students.

Random matching of lip and palatal rugae patterns with their corresponding photographs was carried out by dental

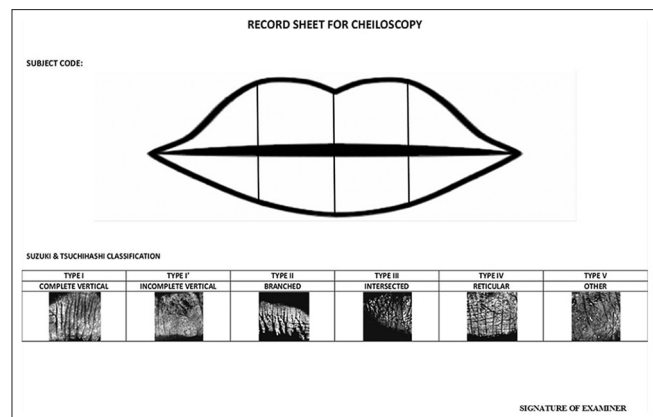


Figure 5: Record sheet for cheiloscopy was prepared as a charting design

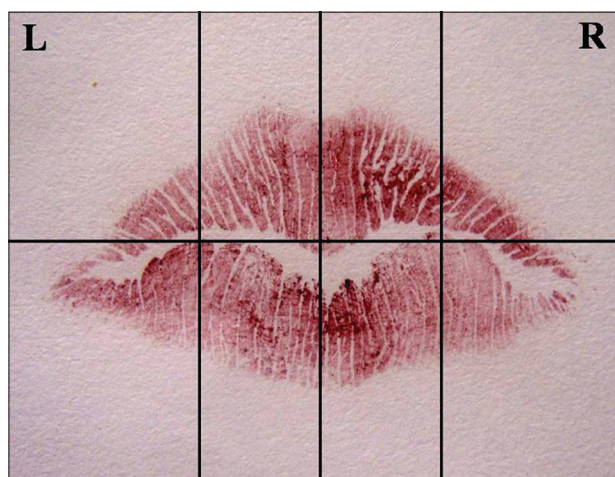


Figure 6: Lip print to be examined divided into quadrants, further into medial and lateral halves

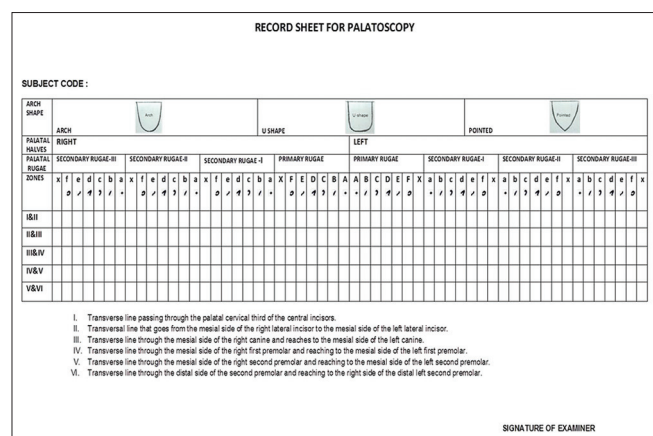


Figure 7: Record sheet for palatoscopy was prepared as a tabular form

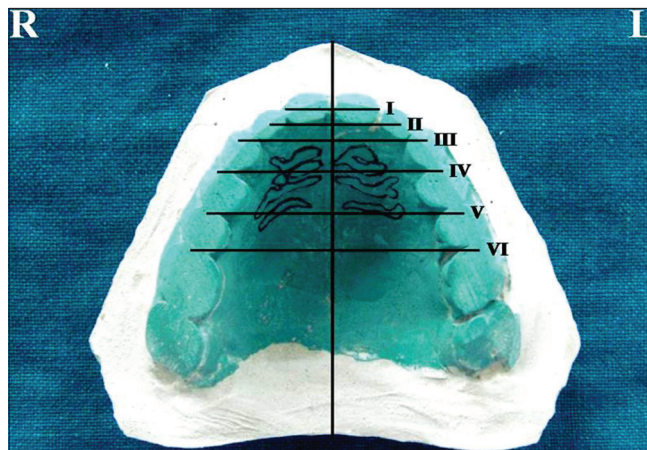


Figure 8: Palatal rugae area to be examined divided into five transverse zones

students before and after teaching using training module. Pre- and post-training results were then compared and statistically evaluated.

Also the ten examiners were asked to individually classify 10 lip print and palatal rugae patterns using record sheet for cheiloscopy and palatoscopy respectively twice (first and second assessment). Results of first and second assessment were compared and evaluated statistically to study the percentage of intraobserver variation using record sheets.

The data was analyzed using Statistical Package for Social Sciences (SPSS), version 15.0 (SPSS Inc., 233 South Wacker Drive, Chicago, IL, USA). Chi-square test was used to compare the data. The level of confidence was kept at 95%, hence a *P* value less than 0.05 indicated a statistically significant association.

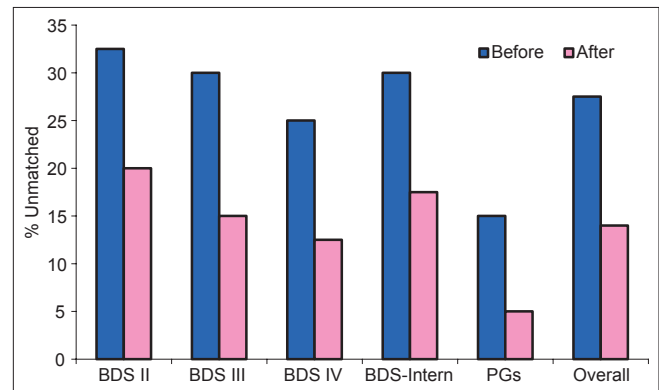
Results

Pre- and post-training results of lip print [Table 1 and Graph 1] and palatal rugae patterns [Table 2 and Graph 2] matching overall shows statistically significant improvement in matching lip prints (*P* = 0.002) and palatal rugae (*P* = 0.008) after the dental students have been trained using training module for cheiloscopy and palatoscopy.

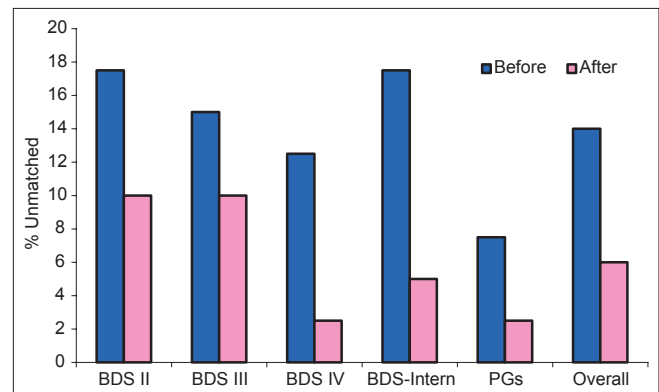
The first and second assessment of lip print and palatal rugae analysis when compared revealed overall variation or disagreement of 18 and 10%, respectively; which is insignificant [Tables 3 and 4 and Graph 3]. This infers that the intraobserver variation in lip print and palatal rugae analysis using record sheet for cheiloscopy and palatoscopy is insignificant.

Discussion

Sustained education and demand over the past half century has rendered forensic odontology a valuable component



Graph 1: Comparison of unmatched lip print patterns pre and post training



Graph 2: Comparison of unmatched palatal rugae patterns pre and post training

Table 1: Comparison of matched and unmatched lip print patterns pre- and post-training

Examiner	Pre-training		Post-training		Statistical Evaluation	
	Matched	Unmatched	Matched	Unmatched	χ^2	<i>P</i> value
BDS II year	27	13	32	8	1.614	0.204
Examiner 1	14	6	16	4	0.533	0.465
Examiner 2	13	7	16	4	1.129	0.288
BDS III year	28	12	34	6	2.581	0.108
Examiner 3	15	5	18	2	1.558	0.212
Examiner 4	13	7	16	4	1.129	0.288
BDS IV year	30	10	35	5	2.051	0.152
Examiner 5	16	4	18	2	0.784	0.376
Examiner 6	14	6	17	3	1.290	0.256
BDS intern	28	12	33	7	1.726	0.189
Examiner 7	15	5	18	2	1.558	0.212
Examiner 8	13	7	15	5	0.476	0.490
PG students	34	6	38	2	1.053	0.305
Examiner 9	17	3	19	1	1.111	0.292
Examiner 10	17	3	19	1	1.111	0.292
Overall	147	53	172	28	9.675	0.002

BDS: Bachelor of dental surgery; PG: Postgraduate

Table 2: Comparison of matched and unmatched palatal rugae patterns pre- and post-training

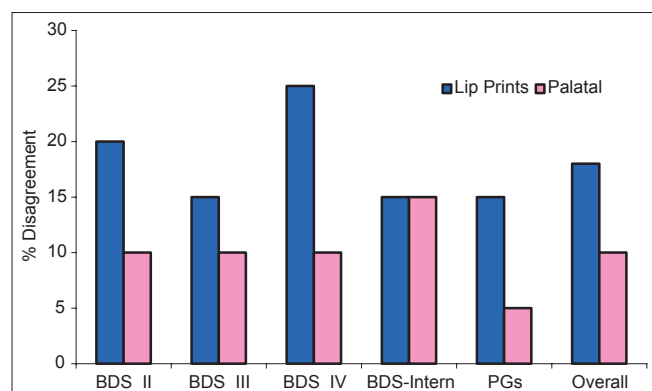
Examiner	Pre-training		Post-training		Statistical Evaluation	
	Matched	Unmatched	Matched	Unmatched	χ^2	P value
BDS II year	33	7	36	4	0.949	0.330
Examiner 1	17	3	18	2	0.229	0.633
Examiner 2	16	4	18	2	0.784	0.374
BDS III year	34	6	36	4	0.457	0.499
Examiner 3	18	2	19	1	0.360	0.548
Examiner 4	16	4	17	3	0.173	0.677
BDS IV year	35	5	39	1	2.883	0.090
Examiner 5	17	3	19	1	1.111	0.292
Examiner 6	18	2	20	0	2.105	0.147
BDS intern	33	7	38	2	3.130	0.077
Examiner 7	17	3	20	0	3.243	0.072
Examiner 8	16	4	18	2	0.784	0.376
PG students	37	3	39	1	1.053	0.305
Examiner 9	18	2	19	1	0.360	0.548
Examiner 10	19	1	20	0	1.026	0.311
Overall	172	28	188	12	7.111	0.008

BDS: Bachelor of dental surgery; PG: Postgraduate

Table 3: Intraobserver variation in lip print analysis

Examiner	No. of variation in lip print analysis in first and second assessment (out of 10)
BDS II year	4
Examiner 1	2
Examiner 2	2
BDS III year	3
Examiner 3	0
Examiner 4	3
BDS IV year	5
Examiner 5	2
Examiner 6	3
BDS intern	3
Examiner 7	1
Examiner 8	2
PG students	3
Examiner 9	2
Examiner 10	1
Overall variation	18/100 (18%)

BDS: Bachelor of dental surgery; PG: Postgraduate



Graph 3: Intra-observer variation in lip print and palatal rugae analysis

of forensic investigations in many countries. Topics such as postmortem dental identification, disaster victim identification, age estimation, anthropology, bite mark analysis, and dental deoxyribonucleic acid (DNA) analysis are successfully being covered at undergraduate level in most of the universities around the world; however, training regarding cheiloscopy and palatoscopy is still deficient.

To simplify the analysis of lip prints and palatal rugae, record sheets for cheiloscopy and palatoscopy have been prepared based on Suzuki and Tsuchihashi classification (1970) and Trobo's classification (1932) along with aforementioned modifications, respectively.

Suzuki and Tsuchihashi in 1970 is the most standardized and simplified classification for lip print reading, when compared to others (Martin Santos (1966), Renaud (1973), Afchar Bayat (1979)),^[3] since it has a clear description of nearly all of the commonly encountered lip patterns and is easy to interpret and apply due to its resemblance to the dental formula.^[1] It was observed that each type of lip groove pattern never occur singly, rather they are always present in combination with other patterns. Also, patterns in medial and lateral parts of lip was found to be different, so each lip quadrant could further be divided into medial and lateral parts for detailed description as it was done by Augustine *et al.*,(2008).^[8]

For palatal rugae analysis, method used by Venegas *et al.*,(2009)^[9] which is based on Trobo's classification system (1932) have been used. It is the most convenient and complete method when compared to others (Lysell's (1955, Thomas and Kotze (1983), etc.);^[3] since in this method along with shape, the location and number of palatal rugae were

Table 4: Intraobserver variation in palatal rugae analysis

Examiner	No. of variation in palatal rugae analysis in first and second assessment (out of 10)
BDS II year	2
Examiner 1	1
Examiner 2	1
BDS III year	2
Examiner 3	0
Examiner 4	2
BDS IV year	2
Examiner 5	1
Examiner 6	1
BDS intern	3
Examiner 7	1
Examiner 8	2
PG students	1
Examiner 9	1
Examiner 10	0
Overall variation	10/100 (10%)

BDS: Bachelor of dental surgery, PG: Postgraduate

defined clearly by dividing the hard palate area into right and left halves as well as into five different transverse zones. Though previously not included; palatal arch shape was also taken into consideration, which could further confirm person's identity.

These record sheets enable the examiner to understand various patterns with the help of their pictorial description that can also be referred at the point of any confusion or dilemma. In the present study, the use of record sheets showed overall improvement in skill of dental students

to interpret lip and palatal rugae patterns, along with insignificant intraobserver variation. Thus, these sheets play an important role as a training or teaching tool in addition to aid in analysis of various patterns, hence should be included as a routine teaching tool in undergraduate dental curriculum by dental council to fill this lacuna.

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