

## Analysis of Lip Print in University Students from Vale do Jequitinhonha

### Análise da Impressão dos Lábios em Universitários do Vale do Jequitinhonha

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#### Abstract

Cheiloscopy is the analysis of the lip prints, grooves, thicknesses, angles, and other structures of the lips that differentiate each individual in a similar way to biometrics. This study aimed to observe these lips characteristics and to verify if there is a labial pattern among the students of the UFVJM Dentistry course of that distinguishes them in genders. Fifty students were selected, photographed, and had their samples collected by printing their lips on transparent tape with wine 01 lipstick, evenly distributed with the aid of a flexible rod and attached on white paperboard and later classified for obtaining the data required for statistical analysis. When analyzing lip thickness, it was found that most of the students had thick lips - 78%, whereas regarding the position of the labial commissure, 50% of the students presented horizontal disposition. Through the classification system of Suzuki and Tsuchihashi the types of furrows were classified, type II being the most common in this research. Despite the evidence that, among the volunteering students, female lips are thinner than male lips, there were no statistically significant differences between men and women. However, there is a need for more studies that seek to validate and disseminate this technique in a standardized way so that it is a complementary tool in Forensic Dentistry.

**Keywords:** Cheiloscopy. Forensic Anthropology. Forensic Dentistry.

#### Resumo

*Queilosopia é a análise das impressões labiais, sulcos, espessuras, ângulos e demais estruturas dos lábios, que diferenciam cada indivíduo de forma similar à biometria. Este estudo teve como objetivo observar as características labiais e verificar se existe um padrão labial entre os estudantes matriculados no curso de Odontologia da UFVJM que os distingue em gênero. Para isto, cinquenta alunos foram selecionados, fotografados e tiveram seus dados coletados por meio da impressão labial em fita adesiva transparente com batom vinho 01, distribuído uniformemente com o auxílio de uma haste flexível e anexada em cartolina branca e, posteriormente, classificadas para obtenção dos dados necessários à análise estatística. Ao analisar a espessura labial, constatou-se que a maioria dos estudantes possuíam lábios grossos - 78%, já em relação a posição da comissura labial 50% dos alunos apresentaram disposição horizontal. Através do sistema de classificação de Suzuki e Tsuchihashi foram classificados os tipos de sulcos, sendo o tipo II o mais comum entre os sujeitos da pesquisa. Apesar da comprovação de que, entre os estudantes voluntários, os lábios femininos possuem menor espessura que os masculinos, não existindo diferenças estatisticamente significativas entre homens e mulheres. Contudo, existe a necessidade de mais estudos que busquem validar e difundir esta técnica de forma padronizada para que seja uma ferramenta complementar na Odontologia Forense.*

**Palavras-chave:** *Queilosopia, Antropologia Forense, Odontologia Legal.*

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#### 1 Introduction

Human identification is of paramount importance and is indeed challenging because each individual has different characteristics.<sup>1</sup> This requires a combination of different procedures to individualize a person. In the human identification process, mouth allows an infinite number of possibilities. In fact, the lips, the palatal rugae and the teeth have characteristics that can lead to a person's identification.<sup>2</sup>

The individual characteristics presented by the lips refer to fingerprints and that there are indicators of uniqueness. The lines and grooves in the labial mucosa form a characteristic pattern called lip prints, the study of which is known as cheiloscopy.<sup>3</sup> It can be defined as a method of identifying an individual based on arrangements of the lines that appear on

the lips.<sup>4</sup>

The phenomenon found in the groove systems in the red part of human lips was first observed by anthropologists. Fisher was the first to describe it in 1902.<sup>2</sup> It is possible to identify lip patterns as early as the sixth week of intrauterine life. Subsequently, lip-groove patterns rarely change<sup>5</sup> and differ from one individual to another - even though it is not frequently used, with the advancement of forensic investigation techniques, it proves to be increasingly effective, since a lip impression found at a crime scene can be the basis of conclusion as to the character of the event, number of people involved, habits, use of cosmetics and pathological changes in lips.<sup>6</sup>

Lipsticks produce a lip print which can be easily

studied, that is, a visible lip print.<sup>7</sup> Although the lips can be photographed directly, covering them with lipstick allows a better view of these grooves.<sup>2</sup> Therefore, the lip prints left can be used to provide direct access to potential suspects and/or victims.<sup>2</sup>

Few studies have been carried out to evaluate the uniqueness of lip prints, as well as their role in human identification by analyzing the types of grooves, thickness and the location of the lip commissure of Brazilian students, of both sexes, aiming to help the diffusion of this technique as an alternative way to optimize and contribute to criminal investigation. Therefore, the present study was carried out to document and evaluate different patterns of lip grooves in the population, with an attempt to assess the probability of gender determination based on the pattern of lip grooves.

## 2 Material and Methods

The convenience sample consisted of 50 volunteering students (25 males and 25 females) of the Dentistry course at the Biological and Health Sciences School - UFVJM, aged 18 to 25 years. Research subjects with hypersensitivity to cosmetics and those who presented inflammation, trauma, malformation, or other specificities in the oral or perioral region were not included in the study. Informed consent was obtained from all study subjects, together with the approval of the institutional ethics committee (CAAE: 94091018.5.0000.5108; protocol - n° 2.800.299).

According to the methodology adopted for a study carried out by Augustine et al.,<sup>6</sup> the data collection for the study was based on three steps: the lip thickness measurement, the lip commissures classification and the individual's sulcular pattern evaluation.

For the lip prints analysis, a single layer of 01 wine-colored lipstick (Zanphy, Shalom Distribuidora de Cosméticos Ltda, São José dos Campos, SP - Brazil) was applied evenly with the tip of a cotton swab at the central portion toward the side of the upper and lower lip, after the lips were cleaned with tissue paper. Subjects were asked to press their lips together to ensure that the lipstick was applied evenly. After two minutes of waiting, lip prints were recorded on the adhesive portion of the cellophane tape, placing the tape over the lips, and applying light pressure. These records were then immediately stuck onto white A4 sheets, carefully sticking the cellophane tape.<sup>6</sup>

For analysis, each lip impression was divided topographically into four quadrants: first quadrant (upper right hemiarch); second quadrant (upper left hemiarch); third quadrant (lower right hemiarch); fourth quadrant (lower left hemiarch). The impression analysis was based on the numerical superiority of the visible line patterns in the studied area.<sup>8</sup> If two patterns predominated, the lip impression would be considered indeterminate. For further categorization of lip impressions, the method proposed by Suzuki and Tsuchihashi<sup>9</sup>

was followed, which is as follows. Type 1 presented distinct vertical grooves that cross the entire lip; type 1 was similar to type 1 but did not extend the entire lip surface; type 2 was branched grooves; type 3 showed crossed grooves; type 4 presented reticular grooves; and type 5 included grooves that could be determined morphologically.

Then, the lips were cleaned with a napkin, using a digital caliper to measure the upper and lower lip thickness individually, at the midline level. The lip measurement was performed so that the examiner positioned himself or herself frontally to the research subject (at a distance of 30 cm) and the examinee with the Frankfurt Plan parallel to the ground. Lip thickness was analyzed using the classification: thin lips (thickness less than 8mm); medium lips (characterized by having a more rounded mucosa, with thickness ranging from 08 to 10 mm); thick or very thick lips (large and very voluminous lips, measuring more than 10 mm), with a very marked lip cord and mixed lips (lips that denote two of the different classifications already mentioned).<sup>10-12</sup>

The spreadsheet was prepared by assigning numerical values to all the study variables, in which non-parametric descriptive and inferential statistical analysis (Pearson's Chi-Square and Fisher's Exact Tests) were performed, considering the significance level of 5% ( $p$  value = 0.05). The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 20.0 (SPSS Inc., Chicago, IL, USA). The evaluators will be confronted to describe the intensity of the agreement among the researchers through Levene test to ascertain the homogeneity of the variances.

## 3 Results and Discussion

Cheiloscopy is a genuine methodology of Legal Dentistry, involving the participation of the dental surgeon and can be a contributing component in forensic investigation. The lips surface has peculiar characteristics that end up being used in the detection and identification of lip impressions in places of any nature, which can reveal important evidence for forensic investigations,<sup>13</sup> since the pattern never goes through changes from birth until the body undergoes decomposition.<sup>14</sup> In addition, one can also perceive the type of event, sex, the use of cosmetics and pathological conditions associated with the lips.<sup>14</sup> However, the use of lip prints in criminal cases is somewhat limited because the credibility of these imprints has not been firmly established in the judicial system yet.<sup>15</sup>

In this study, the lip prints patterns in the 50 individuals evaluated were different. This finding was compatible with the results obtained in similar studies led by Tsuchihashi and Suzuki<sup>16</sup> and other authors.<sup>17-18</sup> This proves that the pattern of lip printing is restricted to each individual.

Regarding the lip thickness, 78% of the total group had thick or very thick lips while 20% of the total group revealed medium lips, with the lowest percentages relative to thin (2%) and mixed lips (0%). Regarding gender, there were no

significant differences among the patterns in question.

Analyzing the results, differences were found in the percentage, which in turn generated the greatest presence of thick or very thick lips, in both genders. In another research, it was evidenced that the frequency of thin lips is more relevant in Caucasians, while thick lips are characteristic in Negroids, being the mentioned phenotypes transmitted between generations, following the concepts of heredity.<sup>11</sup> The result obtained in this study can be related to the intense miscegenation found in the Brazilian population, colonized by Europeans, Indians, and Africans. The lip thickness is seen as another useful method in forensic investigation because it allows an initial idea of the dimensions and conformation existing in the lips to be investigated.<sup>19</sup>

When analyzing the labial commissure position, 50% of the total group presented the labial commissures arranged horizontally. In a slightly lower percentage, 44% of the sample pointed to lowered commissures, while 6% classified themselves with a high commissural profile. There were no differences in the entire sample among the labial commissures analyzed in the same individual examined, that is, for both the right and left sides, these anatomical structures were categorically classified in the same way, there was no correlation between sex and type of labial commissure; the results indicated a percentage in the horizontal position as the most frequent one in the studied population, followed by the lowered position. The elevated position was the least present, as noted in other studies.<sup>12,19</sup>

Regarding this position of the labial commissures according to sex, although there is a small tendency for horizontal commissures in males and high in females, such differences were not statistically significant. Similar results were found in a student population in northeastern Brazil,<sup>20</sup> which had a higher incidence of horizontal commissures in males, and high commissures in the female population. For the lowered standard, the referred study found equal percentages for both sexes, as found in that study with 44% for both sexes.

When considering the labial anatomy (Table 1), it was observed that the Type II groove is more prevalent (42%) with no predisposition for sex. Patterns I and IV had a higher frequency in women (22% and 15%, respectively) when compared to men in the investigated sample (17% and 9%). Type V grooves, in contrast to the afore mentioned types, were the most prevalent in male individuals (16%) at the expense of 7% frequency in female lips. The grooves I' and III followed the same trend biasing, with no statistical significance for the said intersection.

Lip print patterns are not just about the thickness or placement of the lip commissure, but also about a mixture of different types of grooves. In this study, type II grooves were most seen followed by type I. This finding was similar to previous studies carried out in the population from India.<sup>17</sup> A similar distribution pattern is also demonstrated in the work of Gopichand et al.<sup>13</sup> in which type II was the most frequent

pattern.

However, some studies have demonstrated the frequency of other types of grooves, which some results described in the literature<sup>10,21</sup> showed that the most prevalent groove pattern would be Type III, which in the results obtained in this study, this type of groove obtained, along with the type I', the lowest prevalence among all types of labial grooves evaluated, and therefore its percentage is quite inexpressive. The varied presentation of lip prints may be due to the difference in sampling methods and the inclusion of diverse population groups with varying ethnicity. However, this unpredictability in the result may be ideal for forensic investigation since the probability of the individual's singularity of the pattern is greater.

Regarding the distribution of the type of lip grooves in relation to gender, several previous studies concluded that, in the male population, the most found type of line is Type III.<sup>9,12,21</sup> The study in question is not in accordance with the investigations cited in terms of the prevalence of the groove type in the male population, in which Type II was the most prevalent. Regarding female individuals, this study agrees with the study of Gondivkar et al.<sup>22</sup> completely, when analyzing the female population alone, the prevalence is observed, in decreasing order of frequency, of Type II (44%) and Type I (22%). However, some studies attempt to relate the prevalence of lip patterns according to the individual's gender<sup>19,24</sup> and as in the present study, no statistically significant differences were observed.

#### 4 Conclusion

It can be concluded that the data found in this study indicate that the characteristics studied do not allow differentiation between genders in the analyzed sample.

#### References

1. Mutalik VS, Menon A, Jayalakshmi N, Kamath A, Raghu AR. Utility of cheiloscropy, rugoscopy, and dactyloscopy for human identification in a defined cohort. *J Forensic Dent Sci* 2013;5(1):2-6. doi: 10.4103/0975-1475.114535.
2. Caldas IM, Magalhães T, Afonso A. Establishing identity using cheiloscropy and palatoscopy. *Review Forensic Sci Int* 2007;5;165(1):1-9. doi: 10.1016/j.forsciint.2006.04.010
3. Randhawa K, Narang RS, Arora PC. Study of the effect of age changes on lip print pattern and its reliability in sex determination. *J Forensic Odontostomatol* 2011;29:45-51.
4. Prabhu RV, Dinkar AD, Prabhu VD, Rao PK. Cheiloscropy: revisited. *J Forensic Dent Sci* 2012;4(1):47-52. doi: 10.4103/0975-1475.99167.
5. Tsuchihashi Y. Studies on personal identification by means of lip prints. *Forensic Sci* 1974;3(3):233-48. doi: 10.1016/0300-9432(74)90034-x.
6. Augustine J, Barpande SR, Tupkari JV. Cheiloscropy as an adjunct to forensic identification: a study of 600 individuals. *J Forensic Odontostomatol* 2008;2(27):44-52.
7. Singh NN, Brave VR, Khanna S. Natural dyes versus lysochrome dyes in cheiloscropy: A comparative evaluation.

- J Forensic Dent Sci 2010;2(1):11-7. doi: 10.4103/0974-2948.71051.
8. Sharma P, Saxena S, Rathod V. Comparative reliability of cheiloscopy and palatoscopy in human identification. *Indian J Dent Res* 2009;20(4):453-7. doi: 10.4103/0970-9290.59451.
  9. Suzuki K, Tsuchihashi Y. A new attempt of personal identification by means of lip print. *Can Soc Forensic Sci* 1971;4:15-8.
  10. Utsuno H, Kanot T, Tadokoro O, Inque K. Preliminary study of post mortem identification using lip prints. *Forensic Sci Int* 2005;149(2-3):129-32. doi: 10.1016/j.forsciint.2004.05.013.
  11. Santos M. Cheiloscopy: A supplementary stomatological means of identification. *Int Microform J Leg Med* 1967;1(2):66-7.
  12. Molano MA, Gil JH, Jaramillo JA, Ruiz SM. Estudio queiloscópico em estudiantes de la Facultad de Odontología de la Universidad de Antioquia. *Rev Facul Odontol Univ Antioquia* 2002;14(1):17-29.
  13. Gopichand PV, Kaushal S, Kaur G. Personal identification using lip prints (Cheiloscopy) - A study in 500 Punjabi females. *J Indo Pac Acad Forensic Odontol* 2010;1:2-2.
  14. El Domiaty MA, Al-gaidi SA, Elayat AA, Safwat MD, Galal SA. Morphological patterns of lip prints in Saudi Arabia at Almadinah Almonawarah province. *Forensic Sci Int* 2010;200(1-3):179.e1-9. doi: 10.1016/j.forsciint.2010.03.042.
  15. Ball J. The current status of lip prints and their use for identification. Review. *J Forensic Odontostomatol* 2002 Dec;20(2):43-6.
  16. Tsuchihashi Y. Studies on personal identification by means of lip prints. *Forensic Sci* 1974 Jun;3(3):233-48. doi: 10.1016/0300-9432(74)90034-x.
  17. Sivapathasundharam B, Prakash PA, Sivakumar G. Cheiloscopy. *Indian J Dent Res* 2001;12(4):234-7
  18. Vahanwala SP, Parekh BK. Study of lip prints as an aid to forensic methodology. *J Indian Dent Assoc* 2000;71:16-9.
  19. Oliveira JA, Rabello PM, Fernandes LCC. Estudo Queiloscópico em Graduandos de Odontologia. *Pesq Bras Odontoped Clin Integr, João Pessoa* 2012;12(4):521-8.
  20. Barros GB, Silva M, Galvão LCC. Estudo queiloscópico em estudantes do curso de Odontologia da Universidade Estadual de Feira de Santana - BA. *Rev Saúde.Com* 2006;2(1):3-11.
  21. Domínguez JM, Romero JL, Capilla MJ. Aportación al estudio de las huellas labiales. *Rev Esp Med Legal* 1975;2(5):25-32.
  22. Gondivkar SM, Indurkar A, Degwekar S, Bhowate R. Cheiloscopy for sex determination. *J Forensic Dent Sci* 2009(2):56-60. doi: <https://doi.org/10.4103/0974-2948.60374>.
  23. Moshfeghi M, Beglou A, Mortazavi H, Bahrololumi N. Morphological patterns of lip prints in an Iranian population. *J Clin Exp Dent* 2016;1;8(5):e550-e555. doi: 10.4317/jced.52921.