

Primljen/ Received on: 16.02.2022.  
Revidiran / Revised on: 24.04.2022.  
Prihvaćen/ Accepted on: 19.05.2022.

ORIGINALNI RAD  
KLINIČKA STUDIJA  
ORIGINAL ARTICLE  
CLINICAL STUDY  
doi: 10.5937/asn2286456P

## MORFOLOŠKE KARAKTERISTIKE BRAZDI USANA KOD GRAĐANA REPUBLIKE SEVERNE MAKEDONIJE UTVRĐENE HEILOSKOPIJOM

### MORPHOLOGICAL CHARACTERISTICS OF THE LIP GROOVES IN CITIZENS OF THE REPUBLIC OF NORTH MACEDONIA DETERMINED BY CHEILOSCOPY

Bojan S. Poposki<sup>1</sup>, Naida H. Babić-Jordamovi<sup>2</sup>, Kiro B. Ivanovski<sup>1</sup>, Ana S. Pejčić<sup>3,4</sup>, Vlatko B. Kokolanski<sup>1</sup>, Damir J. Marjanović<sup>5</sup>, Aneta S. Atanasovska-Stojanovska<sup>1</sup>, Zlatko M. Jakjovski<sup>6</sup>

<sup>1</sup>UNIVERZITET SV. KIRILA I METODIJA, STOMATOLOŠKI FAKULTET SKOPLJE, SKOPLJE, REPUBLIKA SEVERNA MAKEDONIJA

<sup>2</sup>VERLAB ISTRŽIVAČKI INSTITUT ZA BIOMEDICINSKO INŽINJERSTVO, MEDICINSKE UREĐAJE I VEŠTAČKU INTELIGENCIJU, SARAJEVO, BOSNA I HERCEGOVINA

<sup>3</sup>UNIVERZITET U NIŠU, MEDICINSKI FAKULTET, NIŠ, SRBIJA

<sup>4</sup>KLINIKA ZA DENTLNU MEDICINU, NIŠ, SRBIJA

<sup>5</sup>INTERNACIONALNI BURCH UNIVERZITET, SARAJEVO, BOSNA I HERCEGOVINA

<sup>6</sup>UNIVERZITET SV. KIRILA I METODIJA, MEDICINSKI FAKULTET SKOPLJE, INSTITUT ZA SUDSKU MEDICINU, KRIMINALISTIKU I MEDICINSKU DEONTOLOGIJU, SKOPLJE, REPUBLIKA SEVERNA MAKEDONIJA

<sup>1</sup>SS. CYRIL AND METHODIUS UNIVERSITY, FACULTY OF DENTISTRY SKOPJE, SKOPJE, REPUBLIC OF NORTH MACEDONIA

<sup>2</sup>VERLAB RESEARCH INSTITUTE FOR BIOCHEMICAL ENGINEERING, MEDICAL DEVICES AND ARTIFICIAL INTELLIGENCE, SARAJEVO, BOSNIA AND HERZEGOVINA

<sup>3</sup>UNIVERSITY OF NIŠ, FACULTY OF MEDICINE, NIŠ, SERBIA

<sup>4</sup>CLINIC OF DENTAL MEDICINE, NIŠ, SERBIA

<sup>5</sup>INTERNATIONAL BURCH UNIVERSITY, SARAJEVO, BOSNIA AND HERZEGOVINA

<sup>6</sup>SS. CYRIL AND METHODIUS UNIVERSITY, FACULTY OF MEDICINE SKOPJE, INSTITUTE OF FORENSIC MEDICINE, CRIMINALISTICS AND MEDICAL DEONTOLOGY, SKOPJE, REPUBLIC OF NORTH MACEDONIA

#### Sažetak

**Uvod:** Termin „heiloskopija“ definiše se kao proučavanje karakterističnih bora i brazdi (sulci labiorum) koje su prisutne na rumenom delu usana.

**Cilj rada:** Cilj ovog rada je da se utvrde morfološke karakteristike brazdi usana kod tri dominantne nacionalnosti u Republici Severnoj Makedoniji (Makedonci, Albanci, Romi), i da se uporede dobijeni rezultati sa morfološkim karakteristikama brazdi usana kod tri druge populacije različitih geografskih regija.

**Materijal i metode:** U ovo istraživanje smo uključili 150 ispitanika, starosti 25-50 godina, koji su bili podeljeni u tri grupe: Makedonci (50), Albanci (50) i Romi (50). Otisci usana su uzimani mikroskopskim stakalcima i detektovani metodom koja koristi daktiloskopski prah i četku za zaprašivanje. Za tipizaciju otisaka usana koristili smo klasifikaciju po Suzukiju i Tsuchihashiju.

**Rezultati:** Najčešći tip brazdi usana kod populacije u Republici Severnoj Makedoniji su brazde usana tipa II. Nema značajne razlike u prisustvu zastupljenosti različitih tipova brazdi usana na sva četiri kvadranta između muškaraca i žena, kao niti između Makedonaca, Albanaca i Roma. Komparativna analiza je pokazala da populacije sa različitih geografskih područja imaju različite antropološke i morfološke karakteristike brazdi usana.

**Zaključak:** Tip II brazdi usana je najzastupljeniji kod populacije u Republici Severnoj Makedoniji i ne postoji značajna razlika između zastupljenosti različitih tipova brazdi kod tri ispitivane nacionalnosti u ovoj studiji. S obzirom na veliki broj faktora koji mogu uticati na kvalitet otisaka usana, preporučujemo da se pre uzimanja otiska usana uvek uzme bris, kako bi se iz pronađenog traga pokušao izdvojiti DNK materijal. **Ključne reči** usne, forenzična stomatologija, antropologija

#### Corresponding author:

Bojan Poposki, DDM  
E-mail: bpoposki@stomfak.ukim.edu.mk  
Address: St. „Petar Chajkovski“ C3/2, Skopje  
Republic of North Macedonia  
Phone number: +38977593517

#### Abstract

**Introduction:** Cheiloscopy is defined as the study of the sulci labiorum, known as "lip prints".

**Aim of the study:** The aim of this study was to determine the morphological characteristics of the lip grooves in the three dominant nationalities in the Republic of North Macedonia (Macedonians, Albanians, Roma) and to compare the obtained results with the morphological characteristics of the lip grooves in three other populations from different geographical regions.

**Material and methods:** In this research, we included 150 examinees aged 25-50 years and divided them into three groups: Macedonians (50), Albanians (50) and Roma (50). The lip prints were taken using microscopic slides and detected using the dactyloscopic powder and brush method. We used the Suzuki and Tsuchihashi classification to typify the lip prints.

**Results:** The most common type of lip grooves in the population of the Republic of North Macedonia was the type II grooves. There was no significant difference in the presence of different types of lip grooves in the four quadrants between males and females, nor between Macedonians, Albanians and Roma. The comparative analysis showed that populations from different geographical areas had different anthropological and morphological characteristics of the lip grooves.

**Conclusion:** Type II lip grooves are the most common in the population of the Republic of North Macedonia and there is no statistically significant difference between the prevalence of different types of lip grooves in the three nationalities in this study. Considering the large number of factors that can affect the quality of the lip print, we recommend that a swab should always be taken before collecting the lip print in order to attempt to extract DNA material from the found trace.

**Key words:** lips, forensic dentistry, anthropology

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## Uvod

Termin „heiloskopija“ potiče od grčkih reči cheilos što znači „usne“ i skopein što znači „videti“ i definiše se kao proučavanje karakterističnih bora i brazdi (sulci labiorum) koje su prisutne na rumenom delu usana, a nazivaju se i otisci usana<sup>1</sup>.

Značaj heiloskopije povezan je sa činjenicom da su otisci usana jedinstveni za svaku osobu, što se ne odnosi jedino na monozigotne blizance<sup>2</sup>. Poput otisaka prstiju i nepca, brazde na usnama su trajne tokom celog života<sup>3</sup>.

Sekret koji potiče iz lojnih i mukoznih pljuvačnih žlezdi, koje se nalaze na prelaznoj zoni između rumenog i sluzokožnog dela usana i vlaženje usana jezikom, omogućavaju formiranje latentnog otiska usana pri njenom kontaktu sa određenom površinom<sup>4</sup>. Moguće je naći otiske usana kod različitih krivičnih dela, kao što su: provala, silovanje, ubistvo, itd. U zavisnosti od krivičnog dela, moguće je naći otiske usana na različitim fizičkim površinama: košuljama, maramicama, šoljama, fotografijama, pismima, staklenim površinama, priboru za jelo, opušcima, odeći, pa čak i na biološkim površinama, kao što je koža<sup>5,6</sup>.

Veći broj autora dao je svoje klasifikacije za opis otisaka usana<sup>7,8</sup>, ali se u literaturi najčešće sreće klasifikacija data od strane Suzukija i Tsuchihashija<sup>7-11</sup>. Prema ovoj klasifikaciji otisci usana se dele na 6 tipova: tip I – potpuno vertikalni, tip I' – nepotpuno vertikalni, tip II – razgranati, tip III – ukršteni, tip IV – mrežasti i tip V – nepravilni<sup>12</sup> (Slika 1).

Istraživanja brojnih naučnika<sup>13-26</sup>, potvrdila su da postoji razlika u zastupljenosti pojedinih morfoloških tipova brazdi usana između muškaraca i žena, između različitih rasa kao i različitih populacionih grupa.

U Republici Severnoj Makedoniji, do sada nije sprovedeno istraživanje za utvrđivanje morfoloških karakteristika brazdi usana kod različitih nacionalnosti.

Cilj ovog rada je da se utvrde morfološke karakteristike brazdi usana kod tri dominantne nacionalnosti u Republici Severnoj Makedoniji (Makedonci, Albanci, Romi) i da se uporede dobijeni rezultati sa morfološkim karakteristikama brazdi usana kod tri druge populacije različitih geografskih regija.

## Introduction

The term “cheilosophy” is derived from the Greek words cheilos meaning “lips” and skopein meaning “to see” and is defined as the study of the characteristic wrinkles and grooves (sulci labiorum) present on the vermilion of the lips, also called lip prints<sup>1</sup>.

The importance of cheilosophy is related to the fact that lip prints are unique to one person, except in monozygotic twins<sup>2</sup>. Like fingerprints and palatal rugae, lip grooves are permanent throughout life<sup>3</sup>.

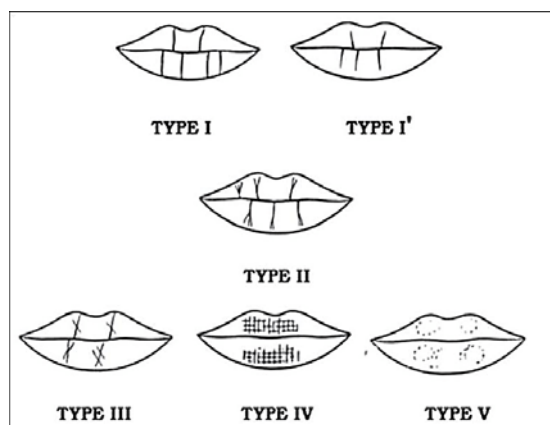
The oily and moist secretions from sebaceous and salivary glands located at the vermilion border, as well as subsequent moisturization of the lips from the tongue, enable the formation of a latent lip print whenever there is a lip contact with a surface<sup>4</sup>. Lip prints are likely to be encountered in various crime scenes, such as: burglary, sexual assault, homicide etc. Depending on the crime, lip prints may be found on various physical surfaces, such as: shirts, handkerchiefs, cups, photographs, letters, glass, cutlery, cigarette butts, clothing, and even biological materials such as skin<sup>5,6</sup>.

Various authors have proposed their classifications for the description of lip prints<sup>7,8</sup>, but the most commonly used is the Suzuki and Tsuchihashi classification<sup>7-11</sup>. According to this classification, lip prints are divided into 6 types: type I—complete vertical, type I'—incomplete vertical, type II—branched, type III—intersected, type IV—reticular pattern and type V—irregular<sup>12</sup> (Figure 1).

Through the research of numerous scientists<sup>13-26</sup>, it has been confirmed that there is a difference in the predominance of certain morphological types of lip grooves between males and females, different races, and different population groups.

In the Republic of North Macedonia, so far, no study has been conducted to determine the morphological characteristics of the lip grooves of different nationalities.

The aim of this study was to determine the morphological characteristics of the lip grooves in the three dominant nationalities in the Republic of North Macedonia (Macedonians, Albanians, Roma) as well as to compare the results with three populations from other geographical areas.



**Slika 1:** Klasifikacija brazdi usana (otisci usana) prema Suzuki i Tsuchihashi klasifikaciji<sup>12</sup>  
**Figure 1:** Classification of the lip grooves (lip prints) according to the Suzuki and Tsuchihashi classification<sup>12</sup>

### **Materijal i metode rada**

Predmet analize u ovom istraživanju bili su otisci usana 150 ispitanika (75 muškog pola i 75 ženskog pola). U zavisnosti od nacionalne pripadnosti, ispitanici su podeljeni u tri grupe: Makedonci (50), Albanci (50) i Romi (50). U sve tri grupe podjednako su bili zastupljeni ispitanici oba pola.

Kriterijumi za uključivanje ispitanika u istraživanje:

- ispitanici ne smeju biti genetski povezani;
- ispitanici moraju pripadati jednoj od tri navedene nacionalne skupine;
- ispitanici moraju biti uzrasta od 25 do 50 godina;

Ispitanici sa prisutnim promenama na usnama koje mogu uticati na tačnost rezultata, kao što su urođene ili upalne bolesti usana, hijaluronski fileri usana, ožiljci usana i slično, isključeni su iz istraživanja. Ispitanici koji ne saraduju u procesu uzimanja otiska usana takođe su isključeni iz studije.

Istraživanje je sprovedeno u Biohemijskoj laboratoriji Katedre za oralnu medicinu i parodontologiju, Stomatološkog fakulteta u Skoplju, Univerziteta „Sv. Ćirilo i Metodije“.

Za sprovođenje ovog istraživanja dobijena je saglasnost Etičke komisije Stomatološkog fakulteta u Skoplju.

U toku prikupljanja otisaka usana, korišćene su rukavice za jednokratnu upotrebu. Pre uzimanja otiska usana, usne su temeljno čišćene vlažnom maramicom, kako bi se uklonili svi ostaci hrane, prljavština i ruž sa usana.

### **Materials and method**

The subject of analysis in our study were the lip prints of 150 subjects (75 men and 75 women). Depending on their nationality, the subjects were divided into three groups: Macedonians (50), Albanians (50) and Roma (50). In all three population groups, both genders were equally represented.

Criteria for inclusion of the subjects in the study:

- the examined subjects must not be genetically related.
- the examined subjects must belong to one of the three mentioned national groups.
- the examined subjects must be aged 25 to 50 years.

Subjects with the presence of changes in the lips that might affect the accuracy of the results, such as congenital or inflammatory diseases of the lips, hyaluronic fillers, scarring of the lips, etc., were excluded from the study. Subjects who did not cooperate in the process of taking a lip print were also excluded from the study.

The research was conducted at the Biochemical Laboratory of the Department of Oral and Periodontal Diseases, at the Faculty of Dentistry - Skopje, University "Ss. Cyril and Methodius" in Skopje.

The consent of the Ethics Committee of the Faculty of Dentistry in Skopje was obtained for conducting this research.

Throughout the process of collecting lip prints, we worked with disposable protective gloves. Before taking the lip print, we cleaned the lips with a wet wipe, in order to remove all food debris, dirt, lipstick etc.; and then we

Zatim su usne sušene suvom maramicom da bi se uklonili ostaci vlage poreklom iz vlažne maramice. Pošto se daktiloskopski prah vezuje za mešavinu sekreta znojnih, lojnih i pljuvačnih žlezda, ispitanicima je naloženo da protrljaju jednu o drugu usnu. Cilj trljanja usana bio je da se podstakne lučenje ovih žlezda, ali i da se rumeni deo usana obloži mešavinom sekreta ovih žlezdi. Nakon uzimanja otiska usana, a pre njegove obrade, mikroskopsko stakalce moralo je biti suvo, jer daktiloskopski prah gubi svoju funkcionalnost u prisustvu vode i vlage.

Dva mikroskopska stakla (Pre-Cleaned Blank Microscope Slides Kit, Four E's, New Jersey, USA) bila su neophodna za svakog ispitanika, jedan za gornju usnu i jedan za donju usnu. Mikroskopska stakla vađena su iz pakovanja neposredno pre uzimanja otiska usana, kako ne bi bili kontaminirani. Pri uzimanju otisaka, stakla su držana za ivice, bez dodirivanja njihove radne površine. Zatim se deo mikroskopskog stakla, koji štrči iznad rumenog dela usana pritiskao rotirajućim pokretima, kako bi se registrovao otisak usana. Pritiskanje, odnosno otisak usana uzet je kratkim i brzim pokretom, bez ponavljanja pokreta, doziranim pritiskom, kako se otisak usana ne bi izobličio.

Nakon uzimanja otisaka, korišćena su dva komada crnog papira. Jedan od njih korišćen je kao podloga na koju se vršilo zaprašivanje daktiloskopskim prahom (BVDA – Instant Silver Fingerprint Powder; Harlem, Holandija), a drugi crni papir korišćen je za fiksiranje otisaka gornje i donje usne.

Zaprašivanje je obavljeno četkom od veriverice (daktiloskopska četka) i daktiloskopskim prahom. Pre zaprašivanja mikroskopskog stakla potrebno je ukloniti višak daktiloskopskog praha sa četke. Višak praha može narušiti kvalitet otiska, odnosno smanjiti vizualizaciju brazdi usana. Daktiloskopski prah nanošen je samo na onaj deo mikroskopskog stakla za koji je bilo sigurno da se na njemu nalazi otisak. Pokreti nanošenja daktiloskopskog praha ponavljani su do momenta kada bi se otisak usana mogao videti golim okom.

Na taj način pripremljena mikroskopska stakla, postavljana su na drugi crni papir, na mesto označeno za odgovarajuću usnu. Zatim su mikroskopska stakla sa otiscima usana postavljanim na crni papir fiksirana providnom lepljivom trakom. Po završetku ovog postupka, crni papir sa fiksiranim mikroskopskim staklima bio je spreman za skeniranje i obradu.

dried them with a dry handkerchief in order to remove the moisture from the wet wipe. Because the dactyloscopic powder binds to the mixture of sweat, sebaceous, and salivary glands secretions, subjects were instructed to rub their lips against each other. The reason for rubbing the lips was to stimulate the secretion of these glands, but also to coat the red part of the lips with the mixture of secretions of these glands. After taking the lip print, and before its processing, the microscopic slide must be dry, because the dactyloscopic powder loses its functionality in the presence of water and moisture.

Two microscopic slides (Pre-Cleaned Blank Microscope Slides Kit, Four E's, New Jersey, United States) were necessary for each subject, one for the upper lip and one for the lower lip. The microscopic slides were taken from their packaging at the moment before taking the lip print, in order not to be contaminated. The microscopic slides were used by holding them by their edges, without touching their work surface. Then, with a rotating motion, we pressed the part of the microscopic slide that projects above the red part of the lips in order to register the lip print. The pressing, i.e., the lip print was taken with a short and fast movement, without repetitive movements, with dosed pressure, in order not to distort the lip print.

After taking the print, we used two pieces of black paper. One of the black pieces of paper was used as a foundation on which we performed the dusting with the dactyloscopic powder (BVDA–Instant Silver Fingerprint Powder; Haarlem, The Netherlands), and the other black piece of paper was used for the fixation of the upper and lower lip print.

The dusting was performed using a squirrel hairbrush (dactyloscopic brush) and dactyloscopic powder. Before dusting the microscopic slide, it is necessary to remove the excess dactyloscopic powder. Excess powder can impair the quality of the print, i.e., reduce the visualization of the lip print. We only dusted the part of the microscopic slide where we knew the print was located. The dusting movements were repeated as many times as necessary to ensure that the lip print can be seen with the naked eye.

We placed the microscope slides prepared in this way on the other black paper, in the place marked for the corresponding lip. Then we fixed the microscope slides with the lip impressions placed on black paper with transparent adhesive tape.

Skenirana su fiksirana mikroskopska stakla, koristeći HP 250 laptop i HP LaserJet M1120 MFP skener.

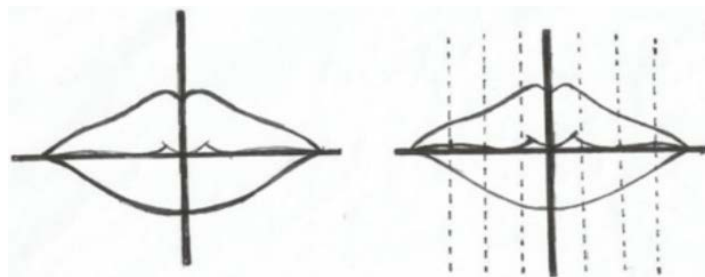
Skenirani otisci obrađivani su uz pomoć Adobe Photoshop CS5 softvera. Sa funkcijom „Invert“, crni delovi skeniranog otiska usana postajali su beli, a beli delovi postajali su crni. Na taj način su otisci brazdi usana bili jasno vidljivi i upotrebljiviji za analizu. Nakon završetka procesa skeniranja, otisci usana bili su spremni za analizu.

Usne su podeljene u četiri kvadranta, crtajući jednu vertikalnu i jednu horizontalnu liniju duž sredine otiska. Označavanje kvadranta usana urađeno je na sledeći način: gornji levi kvadrant (zapravo gornji desni kvadrant usne ispitanika) označen je brojem 1 (prvi kvadrant), gornji desni kvadrant (zapravo gornji levi kvadrant usne ispitanika) brojem 2 (drugi kvadrant), donji desni kvadrant (zapravo donji levi kvadrant usne ispitanika) brojem 3 (treći kvadrant), a donji levi kvadrant (zapravo donji desni kvadrant usne ispitanika) brojem 4 (četvrti kvadrant). Dodatno, svaki kvadrant podeljen je na četiri segmenta, kako bi se lakše utvrdilo koji je morfološki tip brazde dominantan (Slika 2).

Upon completion of this procedure, the black paper with the microscope slides fixed was ready for scanning and processing.

We scanned the print sets using an HP 250 laptop and an HP LaserJet M1120 MFP scanner. We processed the scanned prints with the help of Adobe Photoshop CS5 software. With the 'Invert' function, the black parts of the scanned lip print became white, and the white parts became black. In this way, the lip grooves were clearly visible and usable for analysis. After the processing, the prints were ready for analysis.

We divided the lips into four quadrants, drawing one vertical and one horizontal line along the middle of the print. We marked the upper left quadrant (actually upper right of the subject's lips) with 1 (first quadrant), we marked the upper right quadrant (actually upper left of the subject's lips) with 2 (second quadrant), we marked the lower right quadrant (actually lower left of the subject's lips) with 3 (third quadrant) and the lower left quadrant (actually lower right of the subject's lips) was marked with 4 (fourth quadrant). Additionally, we divided each quadrant into four segments, in order to easily determine which morphological type of the grooves on the lips dominates (Figure 2).



**Slika 2:** Podela usana u četiri kvadranta prema Suzuki i Tsuchihashi klasifikaciji  
**Figure 2:** The division of the lips in four quadrants according to the Suzuki and Tsuchihashi classification

Koristeći klasifikaciju Suzukija i Tsuchihashija<sup>12</sup>, uz pomoć Windows Photo Viewer softvera i alatke „Magnifying Glass“, koja služi kao virtuelna lupa za uvećanje rezolucije otisaka usana, izvršena je vizuelna analiza otisaka usana.

Na ovaj način dobijene su informacije o morfološkom tipu brazdi usana, odnosno morfološkim karakteristikama (dominacija tipa otiska usne) svakog kvadranta. Na osnovu klasifikacije Suzukija i Tsuchihashija<sup>12</sup>, rezultati su uneti u tabelu Microsoft Excel softvera.

Using the Suzuki and Tsuchihashi classification<sup>12</sup>, with the help of Windows Photo Viewer software and the 'Magnifying Glass' tool, which serves as a virtual magnifier to increase the resolution of the lip prints, we performed a visual analysis of the lip prints. In this manner, we obtained information about the morphological type of the lip grooves, that is, the morphological characteristics (lip print type dominance) of each quadrant.

Based on the classification by Suzuki and Tsuchihashi<sup>12</sup>, we recorded the results in a table using Microsoft Excel software.



Statistička analiza obavljena je pomoću softver paketa Microsoft Office Excel i softverskog programa IBM SPSS Statistics, Ver: 28.0.1.1<sup>15</sup>, korišćenjem Hi-kvadrat testa.

## Rezultati

Dominantan tip brazdi usana za svaki kvadrant, kod ispitanika prikazan je u Tabeli 1. U prvom (32,66%), trećem (32,66%) i četvrtom kvadrantu (28%), dominantan tip brazdi usana je tip I, dok u drugom kvadrantu, dominiraju brazde usana tipa II (35,33%). Tip II je dominantan tip brazdi usana kod naših ispitanika.

U Tabeli 2 može se videti raspored brazdi usana po kvadrantima kod ispitanika oba pola. U prvom kvadrantu dominantan tip brazdi kod muškog pola su brazde tipa II, a kod ženskog pola su brazde tipa I. U drugom kvadrantu, dominantan tip brazdi usana su brazde tipa II kod oba pola. U trećem kvadrantu, dominantan tip brazdi usana kod muškaraca su brazde tipa I, a kod žena su brazde tipa II. U četvrtom kvadrantu, dominantni tip brazdi usana su brazde tipa I kod oba pola. Ukupno, kod pripadnika muškog pola dominantni tip brazdi usana je tip II, dok je kod pripadnika ženskog pola dominantan tip brazdi usana, tip I.

U Tabeli 3 prikazana je uporedna analiza tipova brazdi usana kod pripadnika tri različite nacionalnosti, uključenih u ovo istraživanje. U prvom kvadrantu, dominantan tip brazdi usana kod pripadnika makedonske i albanske populacije, je tip I, a kod pripadnika romske populacije dominantan tip brazdi usana je tip II. U drugom kvadrantu, dominantan tip brazdi usana kod pripadnika makedonske i romske populacije je tip II, dok je kod pripadnika albanske populacije dominantan tip brazdi usana tip III. U trećem kvadrantu dominantan tip brazdi usana kod pripadnika makedonske populacije je tip II, a kod pripadnika albanske i romske populacije dominantan tip brazdi usana je tip I. U četvrtom kvadrantu dominantan tip brazdi usana kod pripadnika makedonske populacije je tip II, kod pripadnika albanske populacije je tip I, dok je kod pripadnika romske populacije, dominantan tip brazdi usana, bio tip III.

Za utvrđivanje razlika između muškog i ženskog pola, kao i između pripadnika tri nacionalne grupe, za zastupljenost različitog tipa brazdi usana, korišćen je Hi-kvadrat test. Nije utvrđena značajna razlika u zastupljenosti različitih tipova brazdi usana između muškog i ženskog pola. Takođe, za kategoriju nacionalnost, može se videti da nema značajne razlike zastupljenosti različitih tipova brazdi usana (Tabela 4).

The statistical analysis was performed with the Microsoft Office Excel package and with the software program: IBM SPSS Statistics, Ver: 28.0.1.1 (15), using the Chi-Square test.

## Results

The dominant type of lip grooves for each quadrant in our subjects is shown in Table 1. In the first (32.66%), third (32.66%) and fourth quadrant (28%), the dominant type of lip grooves is type I, while in the second quadrant, type II lip grooves are dominant (35.33%). Type II is the dominant type of lip grooves in our subjects.

In Table 2, we can see the arrangement of the lip grooves by quadrants in the subjects of both sexes. In the first quadrant, the dominant type of lip grooves in the male sex are type II lip grooves, and in the female gender, type I lip grooves. In the second quadrant, the dominant type of lip grooves are type II lip grooves in both sexes. In the third quadrant, the dominant type of lip grooves in men is type I, and in women, type II lip grooves. In the fourth quadrant, the dominant type of lip grooves is type I in both sexes. Overall, the dominant type of lip grooves in males is type II, while in females, the dominant type of lip grooves is type I.

Table 3 shows the comparison of the lip groove types between Macedonians, Albanians and Roma. In the first quadrant, the dominant type of lip grooves in the Macedonian and Albanian population, is the type I lip grooves, and in the Roma population, the dominant type of lip grooves is the type II lip grooves. In the second quadrant, the dominant type of lip grooves in the Macedonian and Roma population is the type II lip grooves, and in the Albanian population, the dominant type of lip grooves is the type III lip grooves. In the third quadrant, the dominant type of lip grooves in the Macedonian population is the type II lip grooves, and in the Albanian and Roma population, the dominant type of lip grooves is the type I lip grooves. In the fourth quadrant, the dominant type of lip grooves in the Macedonian population is the type II lip grooves, in the Albanian population the dominant type of lip grooves is the type I lip grooves and in the Roma population, the dominant type of lip grooves is the type III lip grooves. We used the Chi-square test to determine the differences of the representation of different types of lip grooves between men and women, as well as between members of three national groups.

There is no significant difference in the representation of different types of lip grooves between men and women.

U tabeli 5 prikazana je komparativna analiza različitih tipova brazdi usana kod ispitanika ovog istraživanja i kod ispitanika tri druge populacije različitih geografskih regija (Indija, Nigerija i Japan)<sup>2,26,27</sup>. Iz tabele se može videti da je u Indiji najčešći tip brazdi usana tip I, u Nigeriji je tip II, u Japanu tip III, dok je u Makedoniji najčešći tip brazdi usana tip II.

Also, for the nationality category, it can be seen that there is no significant difference in the representation of different types of lip grooves (Table 4).

Table 5 shows a comparative analysis of different types of lip grooves in our subjects and in three other populations from different geographical regions (India, Nigeria and Japan)<sup>2,26,27</sup>. From the table we can see that in India the most common type of lip grooves is type I, in Nigeria it is type II, in Japan it is type III, while in Macedonia the most common type of lip grooves is type II.

**Tabela 1: Dominantni tip brazdi usana po kvadrantu za ukupan broj ispitanika**  
**Table 1: Dominant type of lip grooves per quadrant for the total number of subjects**

Tip brazdi usana/ Type of lip grooves	Prvi kvadrant/First quadrant	Drugi kvadrant/Second quadrant	Treći kvadrant/Third quadrant	Četvrti kvadrant/Fourth quadrant	Ukupno/Total
I	49	30	49	42	170
I'	2	4	5	4	15
II	42	53	40	39	174
III	35	37	32	38	142
IV	21	25	23	26	95
V	1	1	1	1	4

**Tabela 2: Poređenje tipova brazde za usne između muških i ženskih subjekata**  
**Table 2: Comparison of the lip groove types between the male and female subjects**

Tip brazdi usana/ Type of lip grooves	Prvi kvadrant/ First quadrant		Drugi kvadrant/ Second quadrant		Treći kvadrant/ Third quadrant		Četvrti kvadrant/ Fourth quadrant		Ukupno/Total	
	M	F	M	F	M	F	M	F	M	F
I	21	28	14	16	27	22	22	20	84	86
I'	0	2	1	3	1	4	0	4	2	13
II	25	17	28	25	16	24	20	19	89	85
III	17	18	19	18	21	11	21	17	78	64
IV	11	10	12	13	10	13	12	14	45	48
V	1	0	1	0	0	1	0	1	2	2

**Tabela 3:** Poređenje tipova brazdi usana između Makedonaca, Albanaca i Roma  
**Table 3:** Comparison of the lip groove types between the Macedonians, Albanians and Roma

Tip brazdi usana Nacionalnost / Type of lip grooves/Nationality	Prvi kvadrant/First quadrant			Drugi kvadrant/Second quadrant			Treći kvadrant/Third quadrant			Četvrti kvadrant/Fourth quadrant		
	MK	AL	RO	MK	AL	RO	MK	AL	RO	MK	AL	RO
I	16	21	12	8	14	8	14	16	19	12	18	12
I'	2	0	0	2	2	0	0	3	2	1	2	1
II	14	11	17	23	12	18	20	10	10	23	8	8
III	9	13	13	8	16	13	9	15	8	8	14	16
IV	9	4	8	9	5	11	7	5	11	6	8	12
V	0	1	0	0	1	0	0	1	0	0	0	1

**Tabela 4:** Hi-kvadrat test za četiri kvadranta (pol i nacionalnost)  
**Table 4:** Chi-Square test for the four quadrants (sex and nationality)

Hi-kvadrat test (pol)/Chi-square test (sex)				
		Vrednost/Value	Df	Asimptotski značaj (2strani)/ Asymptotic Significance (2-sided)
Prvi kvadrant/First quadrant	Pearson Chi-Square	5.600 <sup>a</sup>	5	0.347
Drugi kvadrant/Second quadrant	Pearson Chi-Square	2.370 <sup>a</sup>	5	0.796
Treći kvadrant/Third quadrant	Pearson Chi-Square	8.427 <sup>a</sup>	5	0.134
Četvrti kvadrant/Fourth quadrant	Pearson Chi-Square	5.696 <sup>a</sup>	5	0.337
Hi-kvadrat test (nacionalnost)/Chi-square test (nationality)				
Prvi kvadrant/First quadrant	Pearson Chi-Square	12.690 <sup>a</sup>	10	0.242
Drugi kvadrant/Second quadrant	Pearson Chi-Square	14.723 <sup>a</sup>	10	0.143
Treći kvadrant/Third quadrant	Pearson Chi-Square	15.698 <sup>a</sup>	10	0.109
Četvrti kvadrant/Fourth quadrant	Pearson Chi-Square	20.643 <sup>a</sup>	10	0.024



**Tabela 5:** Usporedna analiza usnih brazde između naše zemlje i još tri geografska područja  
**Table 5:** Comparative analysis of the lip grooves between our country and three other geographical areas

Tip brazdi usana/ Type of lip grooves	Indija/India	Nigerija/Nigeria	Japan/Japan	Severna Makedonija/ North Macedonia
I	61.5	6.8	26.5	27.5
I'	56.4	0	0	2.43
II	29	53.6	21.8	29.94
III	24.7	9.1	32.81	23.46
IV	53.1	27.8	12.5	16.01
V	59.5	2.8	6.2	0.64

### Diskusija

Lična identifikacija veoma je značajna u savremenom društvu, zbog socijalnih, ali i zakonodavno-pravnih aspekata. Identifikacija zuba, otisci prstiju i procena DNK možda su najčešće metode koje se koriste u procesu identifikacije. Međutim, ove metode ne mogu biti korisni u svim okolnostima. Zbog toga je ponekad za identifikaciju osoba neophodno primeniti druge i manje poznate metode kao što su heiloskopija i rugoskopija<sup>24</sup>.

Najčešće pominjane metode u literaturi, kada je u pitanju uzimanje otisaka usana, su metoda karminom<sup>2</sup> i metoda korišćenjem aluminijumske/magnetne prašine (puder)<sup>28</sup>. Prilikom izbora metode prikupljanja otisaka usana u naučnoistraživačkim studijama, treba uzeti u obzir da usne predstavljaju prilično pokretnu strukturu. Ova činjenica ukazuje na to da se kod iste osobe mogu dobiti različiti otisci usana, u zavisnosti od pritiska koji se primenjuje, pravca uzimanja otiska usana, kao i metode koja se koristi za analizu otisaka.

Kada se koristi karmin za usne, mora se biti oprezan sa količinom karmina koji se nanosi na usne subjekta, jer ako se nanese deblji sloj karmina, postoji rizik od toga da se popuni deo brazdi usana. Taj deo se kasnije neće videti kao otisak usana. Takođe postoji velika verovatnoća razmazivanja otiska usana.

Kada se govori o temeljnoj analizi brazdi rumenog dela usana, treba napomenuti da pri analizi treba obratiti pažnju na broj brazdi, njihov pravac i njihovu zakrivljenost, kao i na dužinu svake brazde.

### Discussion

Personal identification is very important in modern society due to social, but also legislative and legal aspects. Dental identification, fingerprints, and DNA evaluation are possibly the most frequently used methods in the identification process. However, these methods cannot be useful in all circumstances. Therefore, it is essential to apply other and less known methods such as cheiloscopy and rugoscopy for identification<sup>24</sup>.

The most commonly mentioned methods in literature, when it comes to taking lip prints, are the lipstick method<sup>2</sup> and the method using aluminum/magnetic dust (powder)<sup>28</sup>. When choosing a method for collecting lip prints in scientific research studies, it should be taken into account that lips represent a rather mobile structure. This fact indicates that the same person can produce different lip prints, depending on the pressure applied, the direction of taking the lip print, and the method used to analyze the prints.

When using lipstick, we must be careful with the amount of lipstick applied to the lips of the subject, because provided a larger layer of lipstick is applied, there is a risk of filling in some of the grooves. Those grooves will not appear on the lip print later. There is also a high probability of smearing the lip print.

When talking about a thorough analysis of the grooves of the red part of the lips, it should be noted that the analysis should pay attention to the number of grooves, their path and their curvatures, as well as the length of each groove.

Upotreba karmina smanjuje mogućnost iskorišćavanja potencijala heiloskopije, kao metode za identifikaciju ličnosti. Kako bi se izbegli problemi i nedostaci, koje sa sobom nosi karmin kao metoda analize otisaka usana, te da bi se mogla izvršiti kvalitetna i detaljna analiza otisaka usana, odlučeno je da se u ovom istraživanju koristi aluminijumska prašina (puder)<sup>28</sup>.

Klasifikacija koja je korišćena u ovoj studiji, odnosno klasifikacija Suzukija i Tsuchihashija<sup>12</sup>, najčešće je korišćena klasifikacija brazdi usana, zbog jasnog opisa brazdi, što čini interpretaciju rezultata veoma jednostavnom. Drugi razlog za korišćenje ove klasifikacije je mogućnost upoređivanja rezultata ovog istraživanja sa rezultatima drugih istraživanja.

U sprovedenim istraživanjima<sup>29-33</sup>, potvrđeno je da postoji razlika u zastupljenosti pojedinih morfoloških tipova brazdi usana između muškaraca i žena, različitih rasa i različitih populacionih grupa.

U Severnoj Makedoniji urađeno je samo jedno istraživanje<sup>34</sup> iz oblasti heiloskopije, koje je obuhvatilo samo 30 ispitanika. Ta studija nije se fokusirala na određivanje morfoloških karakteristika brazdi usana. Stoga je cilj ovog istraživanja bio da se utvrdi dominantan tip brazdi usana kod pripadnika tri nacionalne skupine u Republici Severnoj Makedoniji (Makedonci, Albanci i Romi).

Dominantan tip brazdi usana za svaki kvadrant, kod ispitanika ove studije prikazan je u Tabeli 1. U prvom (32,66%), trećem (32,66%) i četvrtom kvadrantu (28%) dominantan tip brazdi usana je tip I, dok u drugom kvadrantu dominiraju brazde usana tipa II (35,33%). Tip II je dominantan tip brazdi usana kod ispitanika ove studije. Rezultati ovog istraživanja podudaraju se sa rezultatima dobijenim u pomenutoj studiji<sup>34</sup>. Mirčevska<sup>34</sup> je na uzorku od 30 ispitanika utvrdila da kod ispitanika u Severnoj Makedoniji dominira tip II brazdi usana.

U brojnim studijama dostupnim u literaturi, vršena su poređenja različite distribucije brazdi usana kod oba pola<sup>8,9,35,36</sup>. Predmet ovog istraživanja bilo je i utvrđivanje dominacije različitih tipova brazdi usana, po kvadrantima, kod oba pola. U Tabeli 2 prikazani su rezultati ovog istraživanja za dominantan tip brazdi usana, po kvadrantima, kod oba pola. Može se primetiti da je u prvom i drugom kvadrantu, kod muške populacije, dominantan tip brazdi usana tip II (33,33% i 37,33%), dok je u trećem i četvrtom kvadrantu dominantan tip brazdi usana tip I (36% i 29,33%). Kod ženske populacije razlikuje se zastupljenost tip brazdi usana. U prvom kvadrantu dominantan tip brazdi usana je tip I

The use of lipstick reduces the possibility of exploiting the potential of cheiloscopy as a method for personal identification. In order to avoid the problems and disadvantages that lipstick brings with it as a method of analyzing lip prints, and to be able to make a high-quality and detailed analysis of lip prints, we decided on the method using aluminum dust (powder)<sup>28</sup> in this study.

The classification we used in this study, i.e., the classification by Suzuki and Tsuchihashi<sup>12</sup>, is the most commonly used classification of lip grooves, due to its clear description of the grooves, which makes the interpretation of the results much simpler. Another reason to use this classification is the possibility to compare our results with the results of other research.

Through the research of numerous scientists<sup>29-33</sup>, it has been confirmed that there is a difference in the predominance of certain morphological types of lip grooves between males and females, different races, and different population groups.

In our country, only one study<sup>34</sup> has been conducted in the field of cheiloscopy, which included only 30 subjects. That study didn't focus on determining the morphological characteristics of the lip grooves. Hence, the aim of our study was to determine the predominant lip pattern found among the North Macedonian population (Macedonians, Albanians and Roma).

The dominant type of lip grooves for each quadrant, in our subjects, is shown in Table 1. In the first (32.66%), third (32.66%) and fourth quadrants (28%), the dominant type of lip grooves is type I, while type II lip grooves dominate in the second quadrant (35.33%). Type II is the dominant type of lip grooves in our subjects. Our results coincide with the results obtained in the mentioned study<sup>34</sup>. Mirčevska<sup>34</sup>, based on a sample of 30 subjects, determined that in our country, type II lip grooves are the most dominant.

In a number of studies available in literature, comparisons have been made regarding the different distribution of lip grooves in both sexes<sup>8,9,35,36</sup>. The subject of interest in our study was also to determine the predominance of different types of lip grooves, by quadrants, in both sexes. Table 2 presents the results for the dominant type of lip grooves, by quadrants, in both sexes. We can observe that in the first and second quadrant, in the male population, the dominant type of lip grooves is the type II (33.33% and 37.33%), while in the third and fourth quadrants, the dominant type of lip grooves is type I (36% and 29.33%). In the female population, the types of lip grooves are represented differently.

(37,33%), dok je u drugom i trećem kvadrantu dominantan tip brazdi usana tip II (33,33% i 32%), a u četvrtom kvadrantu, kao i u prvom, dominantan tip brazdi usana je tip I (26,66%) (Tabela 2). Takođe, može se videti da je dominantan tip brazdi usana kod pripadnika muškog pola tip II, dok je kod pripadnica ženskog pola, dominantan tip brazdi usana tip I. Vredi napomenuti da kod žena, iako dominira tip I brazdi usana, ipak je neznčajna razlika između zastupljenosti tipa I i tipa II brazdi usana. Rezultati dobijeni u ovom istraživanju u saglasnosti su sa rezultatima Topczilko i sar.<sup>37</sup>, koji su utvrdili dominaciju brazdi tipa II kod ispitanika muškog pola i dominaciju brazdi tipa I kod ispitanica ženskog pola. Rezultati ove studije u suprotnosti su sa rezultatima Šimovića i sar.<sup>22</sup> i Gondivkar i sar.<sup>38</sup>, koji su utvrdili dominaciju brazdi usana tipa III kod ispitanika muškog pola i dominaciju tipa II kod ispitanica ženskog pola.

Analiza rezultata Hi-kvadrat testa za kategoriju pol (Tabela 4), po kvadrantima; [ $\chi^2$  (prvi kvadrant) = 5,6,  $p = 0,34$ ;  $\chi^2$  (drugi kvadrant) = 2,3,  $p = 0,79$ ;  $\chi^2$  (treći kvadrant) = 8,4,  $p = 0,13$  i  $\chi^2$  (četvrti kvadrant) = 5,6,  $p = 0,33$ ], ukazuje da nema statistički značajne razlike u zastupljenosti pojedinih tipova brazdi usana između ispitanika muškog i ženskog pola za svaki kvadrant usana. Uočeno je da je odsustvo statistički značajne razlike u prevalenciji pojedinih tipova brazdi usana kod ispitanika muškog i ženskog pola posledica malih razlika između zastupljenosti pojedinih tipova brazdi usana unutar grupe (muški pol / ženski pol), kao i između dve ispitivane grupe.

Analogno rezultatima dobijenim Hi-kvadrat testom za kategoriju pol i rezultati dobijeni pomoću Hi-kvadrat testa za kategoriju nacionalnosti (tabela 4) po kvadrantima; [ $\chi^2$  (prvi kvadrant) = 12,6,  $p = 0,34$ ;  $\chi^2$  (drugi kvadrant) = 14,7,  $p = 0,14$ ;  $\chi^2$  (treći kvadrant) = 15,6,  $p = 0,10$  i  $\chi^2$  (četvrti kvadrant) = 20,6,  $p = 0,02$ ], ukazuju na odsustvo statistički značajne razlike u zastupljenosti pojedinih tipova brazdi usana između Makedonaca, Albanaca i Roma. Iako se numerički gledano, zastupljenost različitih tipova brazdi usana po kvadrantima, razlikuje između tri nacionalne skupine (Tabela 3), ipak je ova razlika statistički neznčajna. Na osnovu rezultata prikazanih u Tabeli 4 može se zaključiti da ne postoji statistički značajna razlika u zastupljenosti brazdi usana između pripadnika makedonske, albanske i romske nacionalnosti.

Analizirajući rezultate ove studije, primećeno je da nacionalnost ispitanika nema statistički značajan uticaj na distribuciju morfoloških karakteristika brazdi usana po kvadrantima.

In the first quadrant, the dominant type of lip grooves is type I (37.33%), in the second and third quadrants, the dominant type of lip grooves is type II (33.33% and 32%), while in the fourth quadrant, just like in the first quadrant, the dominant type of lip grooves is type I (26.66%) (Table 2).

Additionally, we can see that the dominant type of lip grooves in male subjects is type II, and in female subjects, the dominant type of lip grooves is type I. It is worth noting that in female subjects, although type I lip grooves dominates, the difference in the presence of type I and type II lip grooves is minor. The results obtained from our study are consistent with the results of Topczylko et al.<sup>37</sup>, who detected the dominance of type II lip grooves in male population and the dominance of type I lip grooves in female population. The results we have obtained are contrary to the results obtained by Šimović et al.<sup>22</sup> and Gondivkar et al.<sup>38</sup> who detected the dominance of type III lip grooves in male population and the dominance of type II lip grooves in female population.

Analyzing the results of the Chi-Square test for the gender category (Table 4), by quadrants; [ $\chi^2$  (First quadrant) = 5.6,  $p = 0.34$ ;  $\chi^2$  (Second quadrant) = 2.3,  $p = 0.79$ ;  $\chi^2$  (Third quadrant) = 8.4,  $p = 0.13$  and  $\chi^2$  (Fourth quadrant) = 5.6,  $p = 0.33$ ], it is clear that there is no statistically significant difference in the representation of certain types of lip grooves between males and females in each quadrant. We observed that the absence of a statistically significant difference in the prevalence of certain types of lip grooves in males and females is due to the small differences between the representation of certain types of lip grooves within the group (male/female), but also between the two examined groups.

Analogous to the results obtained for the Chi-Square test for the gender category, the results obtained for the Chi-Square test for the nationality category (Table 4), by quadrants; [ $\chi^2$  (First quadrant) = 12.6,  $p = 0.34$ ;  $\chi^2$  (Second quadrant) = 14.7,  $p = 0.14$ ;  $\chi^2$  (Third quadrant) = 15.6,  $p = 0.10$  and  $\chi^2$  (Fourth quadrant) = 20.6,  $p = 0.02$ ], also indicate the absence of a statistically significant difference in the representation of certain types of lip grooves between Macedonians, Albanians and Roma. Although numerically speaking, the representation of different types of lip grooves, by quadrants, differs among the three nationalities (Table 3), this difference is statistically insignificant. The results shown in Table 4 give us the right to claim that there is no statistically significant difference in the presence of lip grooves between Macedonian, Albanian and Roma nationalities.

Zbog toga je urađena dodatna analiza, upoređujući rezultate ove studije sa rezultatima dobijenim iz studija sprovedenih u različitim geografskim oblastima: Indiji, Nigeriji i Japanu<sup>2,26,27</sup> (Tabela 5).

Zaključak je da populacije sa različitih geografskih područja imaju različite antropološke karakteristike, kao i različite morfološke karakteristike brazdi usana.

### **Zaključak**

Analiza dobijenih rezultata, kao i analiza podataka iz literature, omogućile su ostvarenje sledećih zaključaka: najčešći tip brazdi usana kod populacije u Republici Severnoj Makedoniji je tip II. Međutim, ako se ispitanici analiziraju po polu, najčešći tip brazdi usana kod muške populacije je tip II, dok je kod ženske populacije najčešći tip brazdi usana tip I. Ne postoji statistički značajna razlika između prevalencije različitih tipova brazdi usana između ispitanika muškog i ženskog pola, kao ni razlika brazdi usana između tri nacionalne skupine (Makedonci, Albanci i Romi), dok su morfološke karakteristike usana specifične za određenu geografsku populaciju.

Heiloskopija, kao metoda, može se koristiti u forenzičkoj odontologiji, ali njeno korišćenje treba da bude u cilju detaljne analize sistema brazdi na rumenom delu usana, a ne u cilju određivanja pola na osnovu statističkih podataka iz literature. S obzirom na veliki broj faktora koji mogu uticati na kvalitet otisaka usana, može se preporučiti da se pre uzimanja otiska usana uvek uzme bris, kako bi se iz pronađenog traga pokušao izdvojiti DNK materijal.

While analyzing our results, we observed that the nationality of our subjects does not have a statistically significant effect on the distribution of the morphological characteristics of the lip grooves by quadrants. Therefore, we made an additional analysis, comparing our results with the results obtained from studies conducted in different geographical areas: India, Nigeria and Japan<sup>2,26,27</sup> (Table 5).

Our opinion is that populations from different geographical areas have different anthropological characteristics, as well as different morphological characteristics of the lip grooves.

### **Conclusion**

The analysis of our results, as well as the analysis of data from the literature, allowed us to reach the following conclusions: The most common type of lip grooves in the population of the Republic of North Macedonia is type II. However, if we analyze the subjects by gender, the most common type of lip grooves in the male population is type II, while in the female population, the most common is type I. There is no statistically significant difference between the prevalence of different types of lip grooves between males and females, nor between the three national groups (Macedonians, Albanians and Roma), whereas the morphological characteristics of the lips are specific to a certain geographical population.

Cheiloscopy as a method can be used in forensic odontology, but its use should be in terms of detailed analysis of the system of grooves on the red part of the lips, not in terms of determining the sex based on statistical data from literature. Considering the large number of factors that can affect the quality of the lip print, we recommend that a swab should always be taken before collecting the lip print, in order to attempt to extract DNA material from the found trace.

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