

ВАРИЈАЦИИ ВО ТИПОВИ НА ЛИЦЕ И ВЕРОДОСТОЈНОСТ НА ФОТОГРАМЕТРИЈАТА ВО СПОРЕДБА СО АНТРОПОМЕТРИЈА

VARIATIONS IN FACE TYPES AND RELIABILITY OF
PHOTOGRAMMETRY IN COMPARASION WITH ANTHROPOMETRY

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ШТО Е АНТРОПОМЕТРИЈА?

"Се дефинира како системизирана уметност на мерење и набљудување на човекот, неговиот скелет, мозок или други органи, со најсигурни начини и методи за научни цели"

Aleš Hrdlička

Anthropos - човек

metron - мерење

Мерење на лицеви карактеристики кај живи индивидуи со користење на точки на меките ткива кои што ги покриваат соодветните коскени обележја.



ПРЕДНОСТИ

Овозможува директно следење на растот на индивидуата;

Можност за повторно мерење кај истата индивидуа;

Одредување на промени во растот.



НЕДОСТАТОЦИ

Варијации на мекото ткиво;

Непријатност кај пациентите.

ПОДЕЛБА НА АНТРОПОМЕТРИЈАТА

- **Соматометрија** – Телото, вклучувајќи ја главата и лицето
- **Остеометрија** - Долги и кратки коски на скелетот
- **Краниометрија** - Череп
- **Физиометрија** - Телесни и ментални функции

Се користи при мерење на различни делови од лицето за воспоставување:

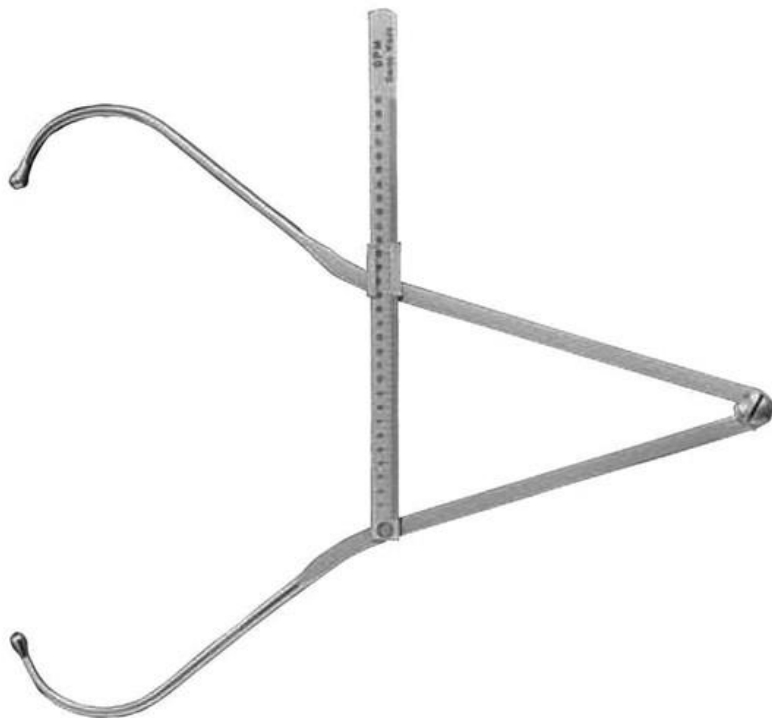
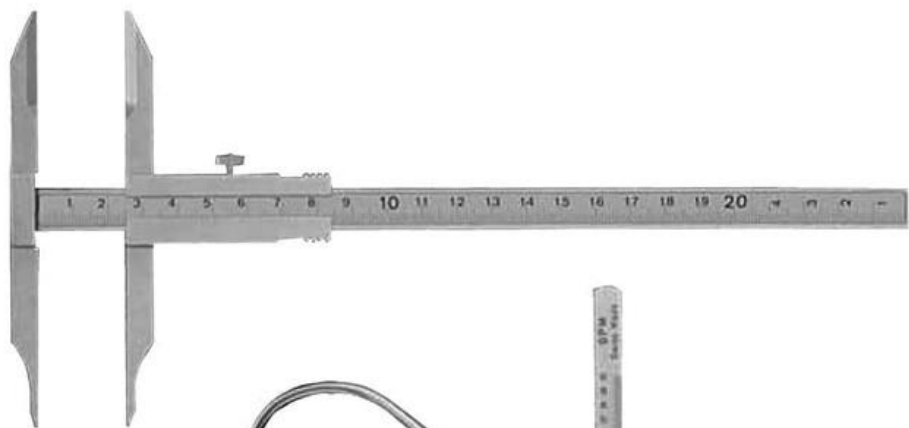
- Дијагноза
- Класификација
- Планирање на третман
- Прогноза

Основното правило - да се измерат само оние делови кои се потребни за да се реши проблемот што се истражува



ИНСТРУМЕНТИ И ТЕХНИКИ ЗА МЕРЕЊЕ

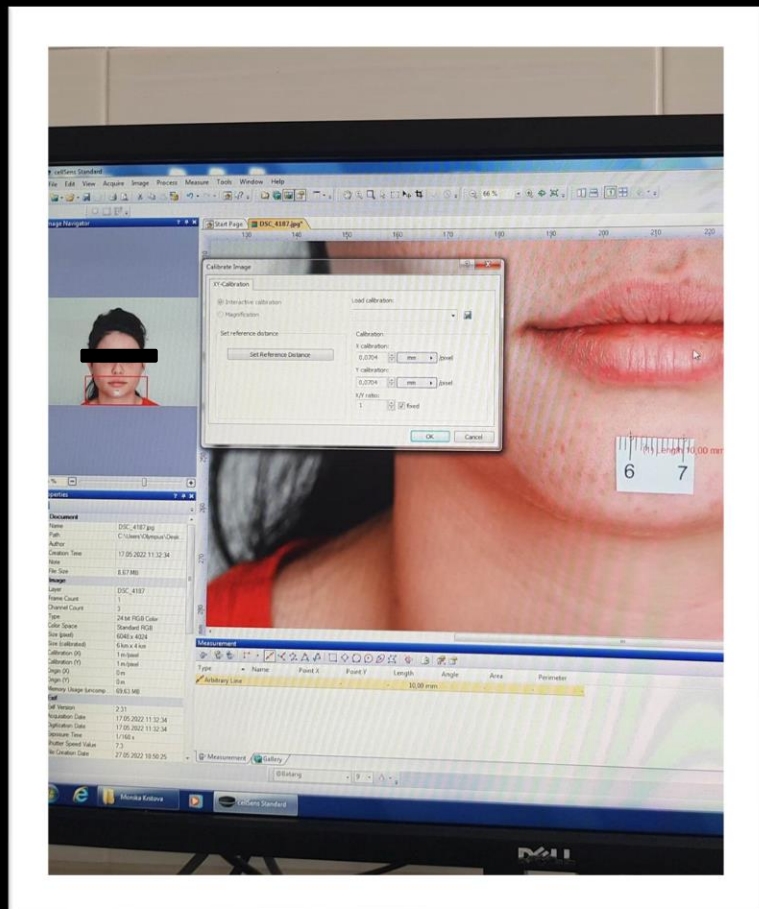
- *Потребно е да бидат точни и прецизни*
- *Да не се деформираат*
- *Практични и лесени за манипулација*
- *Лесно да се транспортираат*
- *Стандарден инструмент: Дигитален шублер – ги мери линеарните растојанија помеѓу две точки во иста рамнина*



Прецизна квантификација на
лицеви карактеристики, како што е
висината на лицето, ширината и
индексот на лице се неопходни во
дијагностицирањето на стекнати и
генетски аберации, проучување на
стандардни и атипични
карактеристики на лице, како и за
морфолошки мерења

ШТО Е ФОТОГРАМЕТРИЈА?

"Фотограметријата може да се дефинира како уметност, наука и технологија за добивање на веродостојни информации преку процеси на фотографирање, мерење и толкување на фотографии"





**ТЕРМИНОТ
ФОТОГРАМЕТРИЈА ПРВПАТ
ГО УПОТРЕБИЛ АЛБРЕХТ
МЕЈДЕНБАУЕР ВО 1867
ГОДИНА.**

Што е анализа на фотографија на лице?

Тоа е методот што го користи клиничарот за евалуација и проценка на лицето на пациентот:

- да ги дефинира неговите пропорции, волумен, изглед, симетрија и видливи деформитети.

Екстраоралните клиничките фотографии му овозможуваат на ортодонтот:

- Да ја проучи состојбата на меките ткива за време на фазата на планирање на третманот.

- Да ги процени естетските карактеристики на макро и мини естетика.

- За истражување и објавување на резултати, користење за научни цели

За екстраоралните клинички фотографии потребно е правилно позиционирање на пациентот и клиничарот, како и правилно поставување на фотоапаратот.

Предности

Фотографиите можат веднаш да се внесат во систем

Лесна манипулација

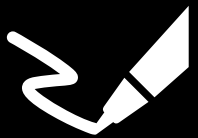
Мерењата полесно се изведуваат, бидејќи пациентите не се движат

Отсуство на грешки предизвикани од притисокот на кожата кои можат настанат за време на антропометрија

Мерењата можат постојано да се повторуваат

Фотографиите и направените анализи можат лесно да се складираат и каталогизираат

Фотографиите и анализите можат веднаш да се препратат на: пациенти, лаборатории, колеги...



Разликата помеѓу фотограметриските и антропометриските мерења е во тоа што растојанието помеѓу две точки треба да се мери во проектирана рамнина, и затоа може во мал дел да се разликува од вистинските мерења.



Висина на лице - вертикалното растојание од точката назион (N') до гнатион (Gn');

Ширина на лице – растојанието помеѓу десната и левата точка зигион (Zy');

Назион (N'): Предната точка на пресекот помеѓу носната и фронталната коска;

Гнатион (Gn'): Најдолната и предна точка на мандибуларна симфиза, односно точка на брадата;

Зигион (Zy'): Најлатерално поставена точка на зигоматичата коска.

Пропорционалниот однос на висината на лицето кон ширината (индексот на лицето), повеќе од апсолутната вредност на било кој, го утврдува типот на лицето и основните пропорции на лицето.



Лицев индекс

висина на лице / ширина на лице
 $\times 100$

$$N - Gn / Zy - Zy \times 100$$

БАНИСТЕР КЛАСИФИКАЦИЈА НА РАЗЛИЧНИ ТИПОВИ НА ЛИЦЕ ВО ОДНОС НА ВРЕДНОСТИТЕ НА ЛИЦЕВИОТ ИНДЕКС

Тип на лице	Лицев индекс
• Хипереурипрозоп	<79.9
• Еурипрозоп	80.0 - 84.9
• Мезопрозоп	85.0 - 89.9
• Лептопрозоп	90.0 - 94.9
• Хиперлептопрозоп	95.0 - >95

Тип на лице

Лептопрозоп / Хиперлептопрозоп

- Долго и тесно лице
- Намалена бизигоматска ширина (намалена ширина на лице)
- Тесна апикална база во трансферзален правец

Еурипрозоп

- Кратко и широко лице
- Зголемена бизигоматска ширина (зголемена ширина на лице)
- Широка апикална база во трансферзален правец

Accuracy and reliability of 3D stereophotogrammetry:

A comparison to direct anthropometry and 2D photogrammetry

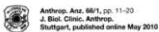
Furkan Dindaroğlu¹; Pınar Kutlu¹; Gökhan Serhat Duran¹; Serkan Görgülü¹; Erhan Aslan¹

ABSTRACT

Objective: To evaluate the accuracy of three-dimensional (3D) stereophotogrammetry by comparing it with the direct anthropometry and digital photogrammetry methods. The reliability of 3D stereophotogrammetry was also examined.

Materials and Methods: Six profile and four frontal parameters were directly measured on the faces of 80 participants. The same measurements were repeated using two-dimensional (2D) photogrammetry and 3D stereophotogrammetry (3dMDflex System, 3dMD, Atlanta, Ga) to obtain images of the subjects. Another observer made the same measurements for images obtained with 3D stereophotogrammetry, and interobserver reliability was calculated for 3D images. Both observers remeasured the same parameters. Statistical analysis was performed using the intraclass correlation coefficient and Bland-Altman plots. Results: The highest agreement was found for the interobserver reliability of 3D stereophotogrammetry (0.21 mm between photographs) and the lowest for the direct anthropometry (0.965 in the Sn-Pm method). Agreement between the two observers was 1 and 1.42 for the direct anthropometry and 2D photogrammetry, respectively. Conclusions: Measurements using 3D stereophotogrammetry were accurate and reliable.

KEY WORDS: Direct anthropometry, digital photogrammetry, 3D stereophotogrammetry, accuracy, reliability



Article

Digital 2D-Photogrammetry and Direct Anthropometry – A Comparing Study on Test Accomplishment and Measurement Data

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With 3 figures and 2 tables

Summary: The aim of this methodological anthropometry and digital two-dimensional photogrammetry study was to compare the reliability of digital and direct methods. The reliability of the digital and direct methods varied greatly depending on which of the 14 anthropometric distances that was being assessed. Only 6 digitally and 5 directly measured anthropometric distances showed both an ICC >0.75 and a MAD <1 mm, in the intra-rater as well as the inter-rater measurements. The Bland-Altman plots and LOA displayed the same pattern. In summary, the digital and direct methods were generally compatible in terms of reliability and agreement. However, the reliability and agreement between the 14 anthropometric measurements were not the same. The main limitation to both modern and traditional anthropometric landmarks warrant further research. The authors also recommend that the MA distance that is being evaluated an

ORIGINAL ARTICLES

Evaluation of Facial Anthropometry Using Three-Dimensional Photogrammetry and Direct Measuring Techniques

Dippe, Katarina MD; Becker, Magnus MD, PhD; Schönhey, Björn MD, PhD

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DOI

Metrics

Abstract

In this study, 14 standard facial distances on 10 adult volunteers were measured directly with a caliper and indirectly on two-dimensional images using the 3dMDtrio system. Two raters performed the measurements with at least 1 week between rating sessions. The intra- and inter-rater reliabilities and agreement of the measurements were calculated using intra-class correlation coefficient (ICC), mean absolute difference (MAD), and Bland-Altman plots with limits of agreement (LOA). The 2 raters had an average discrepancy (MAD) of 1.6 mm when their digital measurements were compared to their direct measurements. The reliability of the digital and direct methods varied greatly depending on which of the 14 anthropometric distances that was being assessed. Only 6 digitally and 5 directly measured anthropometric distances showed both an ICC >0.75 and a MAD <1 mm, in the intra-rater as well as the inter-rater measurements. The Bland-Altman plots and LOA displayed the same pattern. In summary, the digital and direct methods were generally compatible in terms of reliability and agreement. However, the reliability and agreement between the 14 anthropometric measurements were not the same. The main limitation to both modern and traditional anthropometric landmarks warrant further research. The authors also recommend that the MA distance that is being evaluated an

Reliability and Accuracy of 2D Photogrammetry: A Comparison With Direct Measurement

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Objective: Facial anthropometric data is important for the design of respirators. Two-dimensional (2D) photogrammetry has replaced direct anthropometric method, but the reliability and accuracy of 2D photogrammetry has not been quantified. This study aimed to assess inter-rater reliability of 2D photogrammetry and to examine the reliability and accuracy of 2D photogrammetry with direct measurement.

Design: A cross-sectional study.

Setting: Malaysia.

Participants: A subset of 96 participants aged 18 and above.

Primary and secondary outcomes: Ten facial dimensions were measured using direct measurement and 2D photogrammetry. An assessment of inter-rater reliability was performed using intra-class correlation (ICC) of the 2D images. In addition, ICC and Bland-Altman analyses were used to assess the reliability and agreement of 2D photogrammetry with direct measurement.

Results: Except for head breadth and bigonial breadth, which were also found to have low inter-rater reliability, there was no significant difference in the inter-rater mean value of the 2D photogrammetry. The mean measurements derived from direct measurement and 2D photogrammetry were mostly similar. However, statistical differences were noted for two facial dimensions, i.e., bizygomatic breadth and bigonial breadth, and clinically the magnitude of difference was also significant. There were no statistical differences in respect to the remaining eight facial dimensions, where the smallest mean difference was 0.3 mm and biggest mean difference was 1.0 mm. The ICC showed head breadth had poor reliability, whilst Bland-Altman analysis showed seven out of 10 facial dimensions using 2D photogrammetry were accurate, as compared to direct measurement.

Conclusion: Only certain facial measurements can be reliably and accurately measured using 2D photogrammetry, thus it is important to conduct a reliability and validation study before the use of any measurement methods in anthropometric studies. The results of this study also suggest that 2D photogrammetry can be used to supplement direct measurement for certain facial dimensions.

Keywords: 2D photogrammetry, direct measurement, accuracy, facial anthropometric measurements, reliability

Furkan Dindaroğlu, Pınar Kutlu, Gökhan Serhat Duran, Serkan Görgülü, Erhan Aslan; Accuracy and reliability of 3D stereophotogrammetry: A comparison to direct anthropometry and 2D photogrammetry. *Angle Orthod* 1 May 2016; 86 (3): 487–494. doi: <https://doi.org/10.2319/041415-244.1>

Franke-Gromberg, C., Schüller, G., Hermannussen, M., & Scheffler, C. (2010). Digital 2D-Photogrammetry and Direct Anthropometry - A Comparing Study on Test Accomplishment and Measurement Data. *Anthropologischer Anzeiger*, 68(1), 11–20. <http://www.jstor.org/stable/29543077>

Mendonca, D. A., Naidoo, S. D., Skolnick, G., Skladman, R., & Woo, A. S. (2013). Comparative study of cranial anthropometric measurement by traditional calipers to computed tomography and three-dimensional photogrammetry. *The Journal of craniofacial surgery*, 24(4), 1106–1110. <https://doi.org/10.1097/SCS.0b013e31828dcdcb>

Lim, Y. C., Abdul Shakor, A. S., & Shaharudin, R. (2022). Reliability and Accuracy of 2D Photogrammetry: A Comparison With Direct Measurement. *Frontiers in public health*, 9, 813058. <https://doi.org/10.3389/fpubh.2021.813058>

Evaluation of Facial Anthropometry Using Three-Dimensional Photogrammetry and Direct Measuring Techniques

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Author information

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Abstract

In this study, 14 standard facial distances on 10 adult volunteers were measured directly with a caliper and indirectly on two-dimensional images using the 3DMetric system. Two raters performed the measurements with at least 1 week between rating sessions. The intra- and inter-rater reliabilities and agreement of the measurements were calculated using intra-class correlation coefficient (ICC), mean absolute difference

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Original Article

Precision and accuracy assessment of single and multicamera three-dimensional photogrammetry compared with direct anthropometry

Sabbe Staller^a, Justina Anigbo^b, Kelton Stewart^c, Vinicius Dutra^d, Hakan Turkkahraman^e

ABSTRACT

Objectives: To assess the precision and accuracy of single-camera photogrammetry (SCP) and multicamera photogrammetry (MCP) compared with direct anthropometry (DA).

Materials and Methods: A total of 30 participants were recruited, and 17 soft tissue landmarks were identified and used to complete a total of 18 measurements. Using SCP and MCP, two three-dimensional (3D) images were acquired from each participant. All 3D measurements and direct measurements were measured twice by the same operator to assess intrasexaminer repeatability. Intraclass coefficients (ICCs) were used to evaluate intrasexaminer repeatability and intersexaminer agreement of the methods. Nonparametric bootstrap analyses were used to compare the means of the measurements among the three methods.

Results: All three methods showed excellent intrasexaminer repeatability (ICCs > 0.90), except interpupillary distance (ICC = 0.86) measured by SCP. Both SCP and MCP showed excellent intersexaminer agreement (ICCs > 0.90), except interpupillary distance (ICC = 0.79), left gonion-pogonion (ICC = 0.74), and columella-subnasale-labiale superior angle (ICC = 0.86) measured by SCP. Overall, there was good agreement between methods, except for columella-subnasale-labiale superior angle (ICC = 0.40) between SCP and MCP.

Conclusions: Both SCP and MCP techniques were found to be reliable and valid options for 3D facial imaging. SCP produced slightly larger mean values for several measurements, but the differences were within

measurements include

Orthod 2022;92:635–6

KEY WORDS: 3D stere

[Assessment of precision and accuracy of digital surface photogrammetry with the DSP 400 system]

[Article in German]

M Kimmel¹, S Kluba, K Dietz, S Reinert

Affiliations + expand

PMID: 15832575 DOI: 10.1515/BMT.2005.008

Abstract

The objective of the present study was to evaluate the precision and accuracy of facial anthropometric measurements obtained through digital 3-D surface photogrammetry with the DSP 400 system in comparison to traditional 2-D photogrammetry. Fifty plaster casts of left infants were imaged and 21 standard anthropometric measurements were obtained. For precision assessment the measurements were performed twice in a subs

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PERIATRIC/CRANIOFACIAL ORIGINAL ARTICLES

Picture Perfect? Reliability of Craniofacial Anthropometry Using Three-Dimensional Digital Stereophotogrammetry

Heike, Corrie L., M.D., M.S.; Cunningham, Michael L., M.D., Ph.D.; Hing, Anne K., M.D.; Stuhaug, Erik Starr, Jacqueline R., Ph.D., M.S., M.P.H.

Author information

Plastic and Reconstructive Surgery 124(4) pp 1261–1272, October 2009 | DOI: 10.1097/PRS.0b013e3181b454bd

Abstract

Background:

Quantification of facial characteristics is important for research in dysmorphology, odontology, oral and maxillofacial, and plastic surgical disciplines, among others. Three-dimensional surface imaging systems offer a quick and practical method for quantifying craniofacial variation and appear to be highly reliable. However, some sources of measurement error have not yet been thoroughly evaluated.

Methods:

The authors assessed the reliability of using stereophotogrammetry for measuring craniofacial characteristics in 40 individuals, including 20 without craniofacial conditions and 20 with 22q11.2 deletion syndrome. The authors recruited staff and relatives of staff, and individuals with a laboratory-confirmed 22q11.2 deletion. Thirty anthropometric measurements were obtained on participants and on three-dimensional images.

Results:

Intra- and inter-rater reliability for most interlandmark distances on three-dimensional images had intraclass correlation coefficients greater than 95 percent, mean absolute differences of less than 1 mm, relative error measurement less than 1, and technical error of measurement less than 1 mm. The Pearson correlation coefficients of greater than 0.9 for most distances suggest high intermethod reliability between direct and image-based measurements. Three-dimensional image-based measurements were systematically larger for the nasal length and width, forehead, and skull base width, and upper and lower facial widths.

Conclusions:

This study provides further evidence of the high reliability of three-dimensional imaging systems for several craniofacial measurements, including landmarks and interlandmark distances not included in previous studies. The authors also discuss possible errors introduced with palpable landmarks and when working with less compliant participants, such as children. The authors offer guidelines for establishing protocols that can be tailored to each population and research question to maximize the accuracy of image-based measurements.

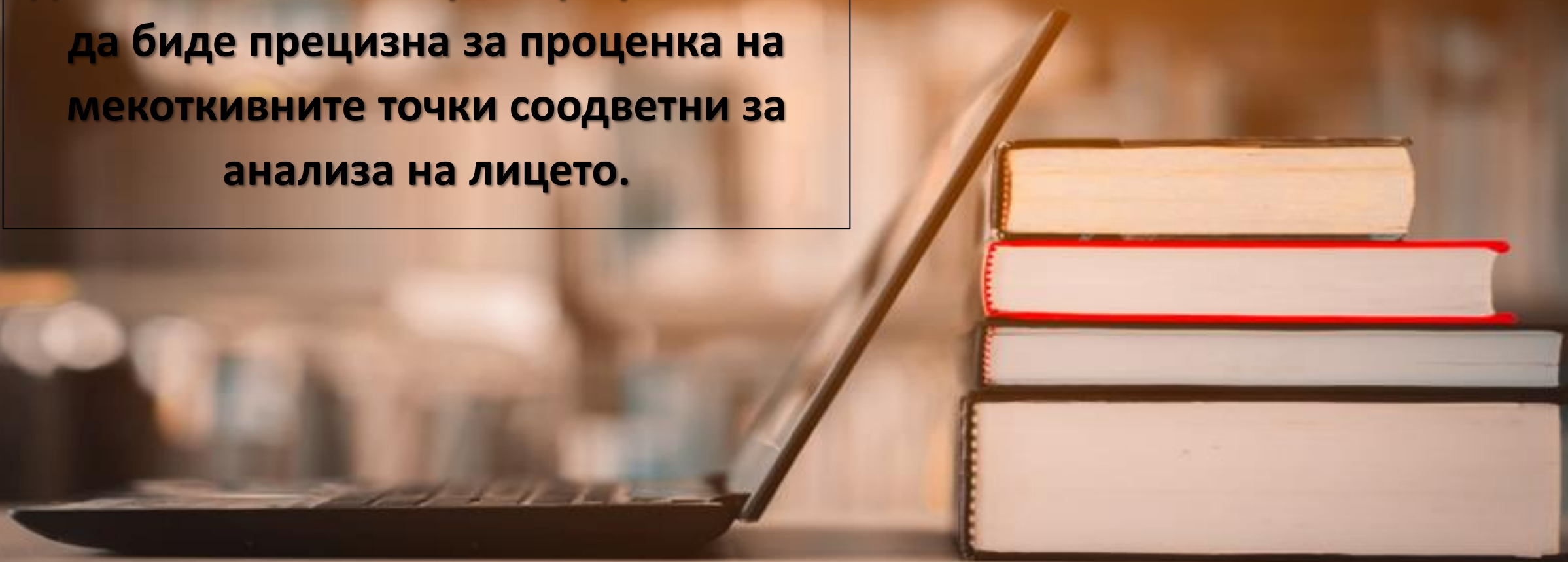
Düppe, K., Becker, M., & Schönmeier, B. (2018). Evaluation of Facial Anthropometry Using Three-Dimensional Photogrammetry and Direct Measuring Techniques. *The Journal of craniofacial surgery*, 29(5), 1245–1251. <https://doi.org/10.1097/SCS.00000000000004580>

Staller, S., Anigbo, J., Stewart, K., Dutra, V., & Turkkahraman, H. (2022). Precision and accuracy assessment of single and multicamera three-dimensional photogrammetry compared with direct anthropometry. *The Angle orthodontist*, 92(5), 635–641. Advance online publication. <https://doi.org/10.2319/101321-770.1>

Kimmel, M., Kluba, S., Dietz, K. & Reinert, S. (2005). Bewertung von Präzision und Genauigkeit der digitalen Oberflächenphotogrammetrie mit dem DSP 400 System / *Assessment of Precision and Accuracy of Digital Surface Photogrammetry with the DSP 400 System.* , 50(3), 45-53. <https://doi.org/10.1515/BMT.2005.008>

Heike, C. L., Cunningham, M. L., Hing, A. V., Stuhaug, E., & Starr, J. R. (2009). Picture perfect? Reliability of craniofacial anthropometry using three-dimensional digital stereophotogrammetry. *Plastic and reconstructive surgery*, 124(4), 1261–1272. <https://doi.org/10.1097/PRS.0b013e3181b454bd>

Студија имаше за цел да процени дали анализата на фотографии може да биде прецизна за проценка на мекоткивните точки соодветни за анализа на лицето.





Морфолошките точки потребни за линеарни мерења се одредени со инспекција и палпација, а потоа се обележани на самото лице. Мерењето на растојанието помеѓу различните точки е направено со дигитален милиметарски шублер

Дигитален фотоапарат Nikon Z6 II - 24.5 MP
(Nikon Corporation)

Објектив NIKKOR Z 85mm f/1.8 и блиц Godox
AD200

Фотографиите се снимаат во режим на RAW
формат, екпортираат во JPG, режим на
фотографирање со експозиција мануелно,
брзина на блендата 1/160 секунди и ISO-800,
бленда F-stop f/6.3.



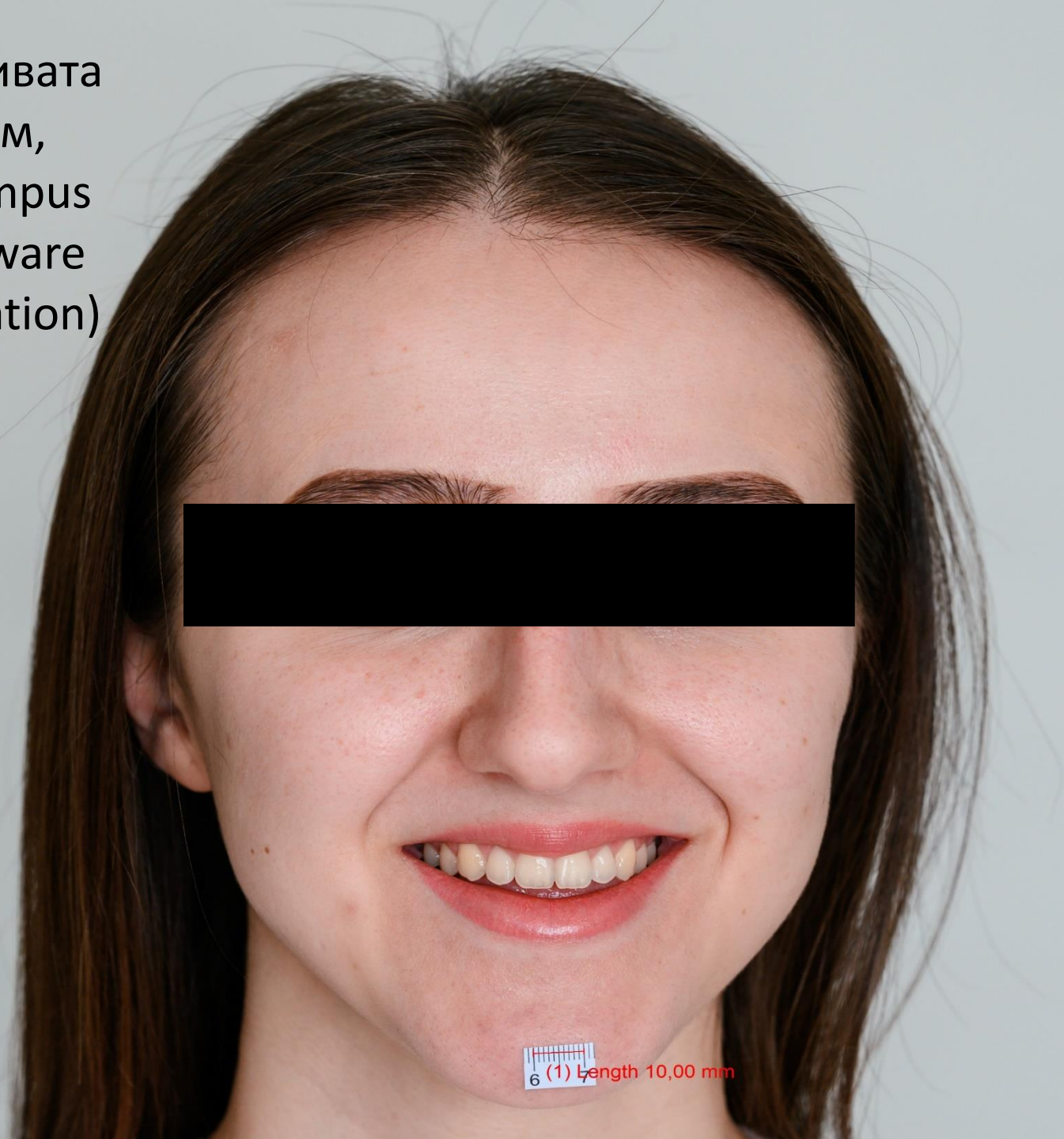
1. Фотоапаратот потребно е да биде фиксиран на статив, на исто ниво како и пациентот;

2. Не треба да има навалување во положбата на фотоапаратот;

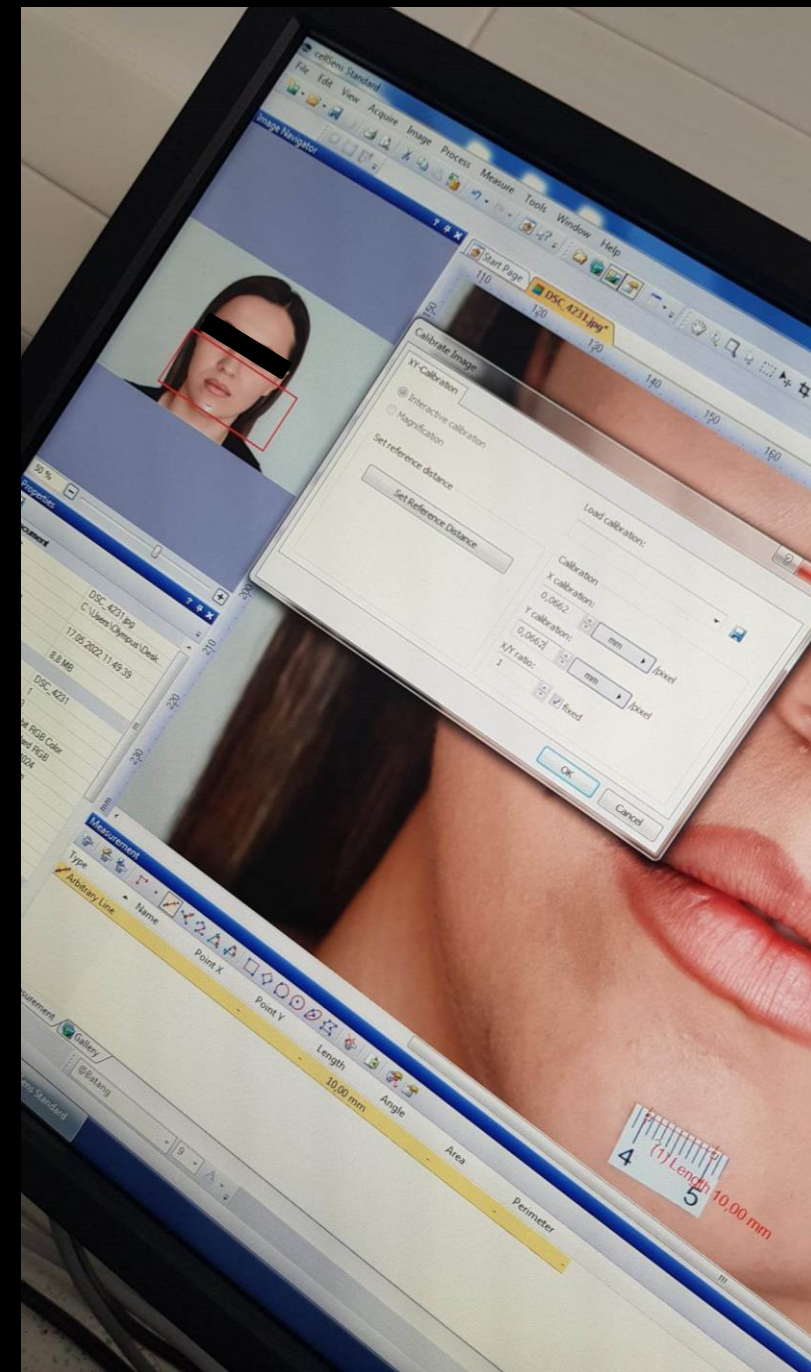
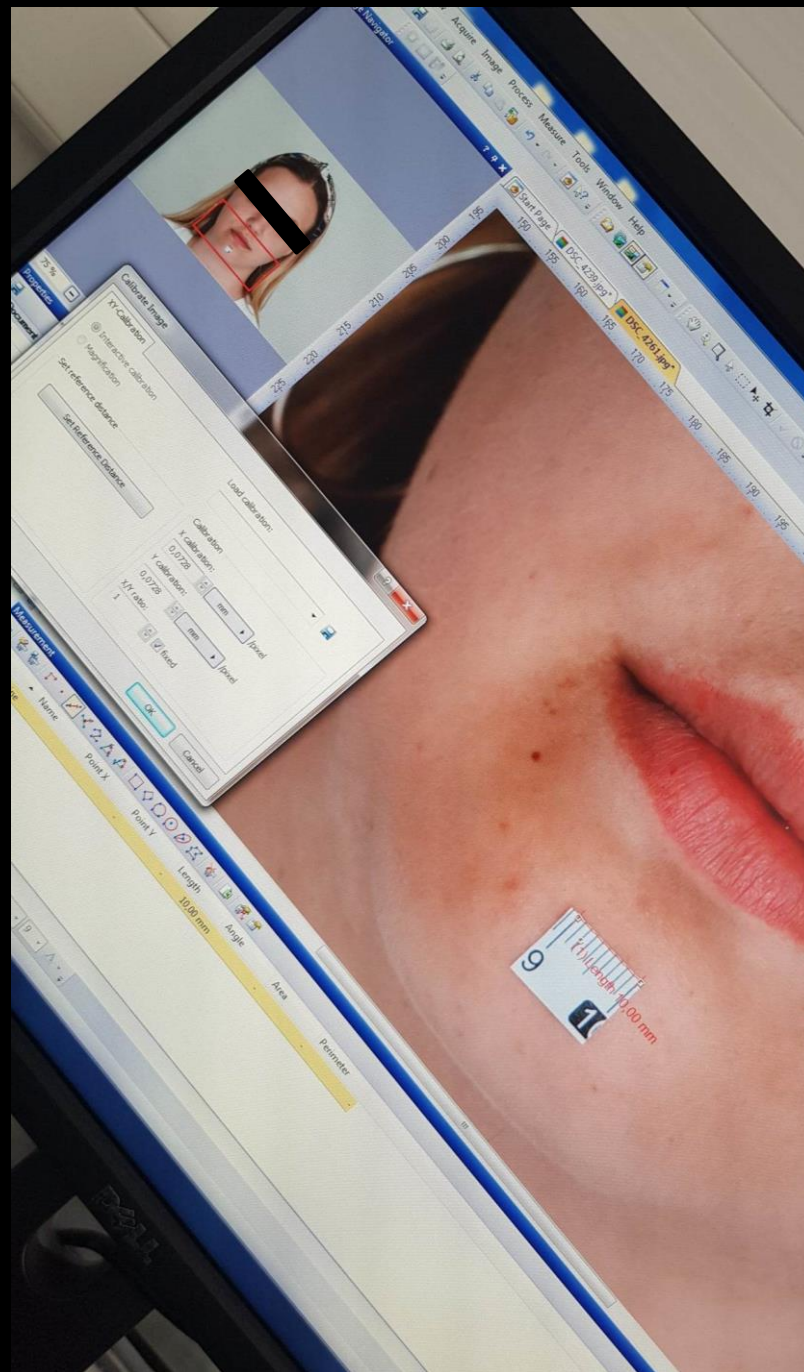
3. Фотографирање врз основ на неутралната, природната положба на главата за секоја фотографија, очите насочени право во објективот на фотоапаратот;

4. Пациентот потребно да ги држи забите и вилицата во опуштена положба, усните во контакт.

Мерење на самолепливата
мерна трака од 10мм,
приспособено на Olympus
cellSens Standard software
(2011 Olympus Corporation)

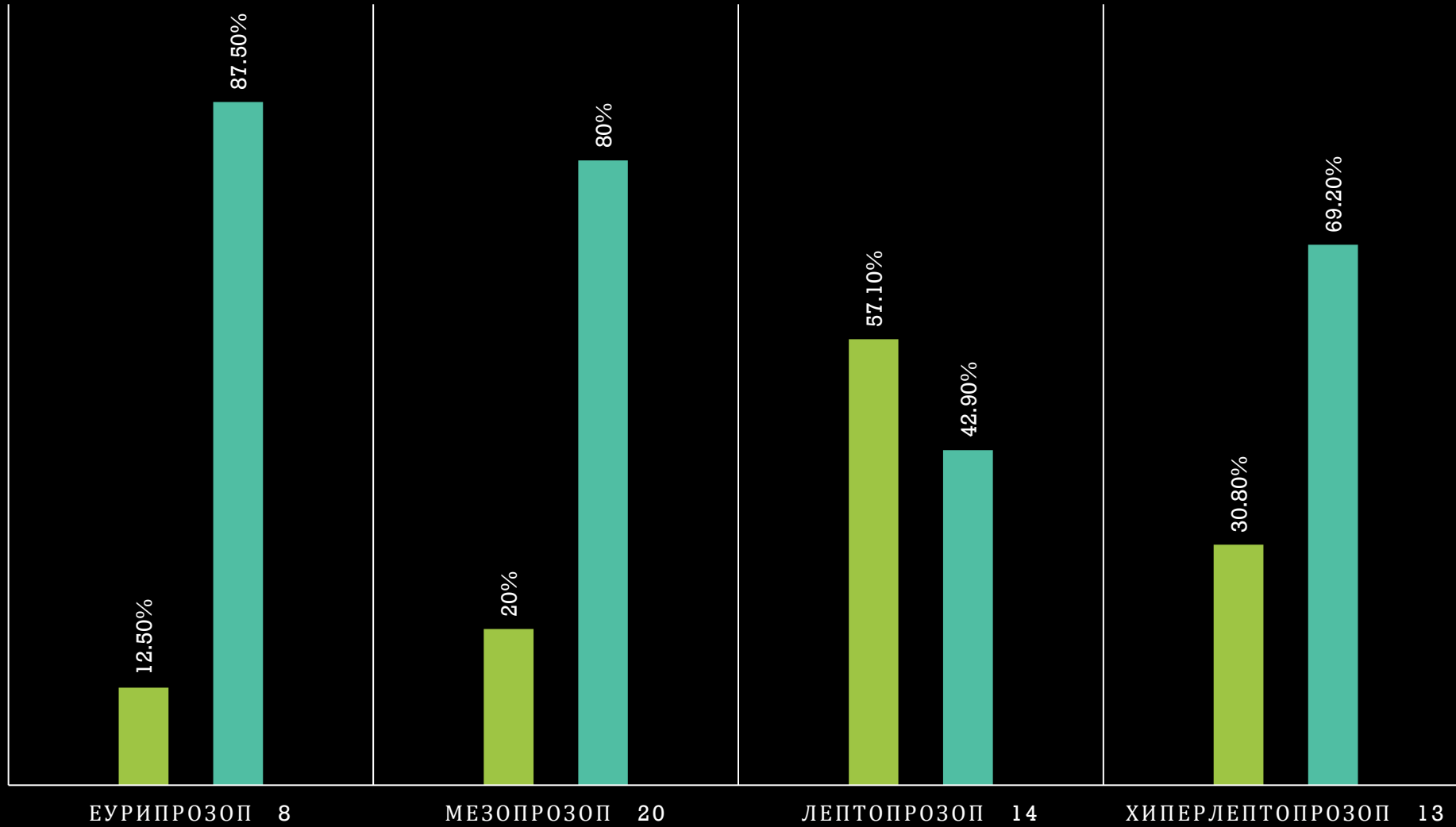


Добиените резултати од мерењата се зачувуваат во Excel табела директно преку Olympus CellSens Standard software. Податоците добиени во текот на истражувањето статистички се обработени.



ТИП НА ЛИЦЕ

■ Мажи ■ Жени



Тип на лице	Пол	
	Мажии (17)	Жени (38)
Еурипрозоп	1	7
Мезопрозоп	4	16
Лептопрозоп	8	6
Хиперлептопрозоп	4	9

Што се однесува до родовиот деморфизам, мажите се претежно лептопросопични (47,06%), а жените мезопросопични (42,1%)

Лицев индекс	Пол	
	Мажи (17)	Жени (38)
Висина на лице N - Gn	123.02±5.59	113.24±5.69
Ширина на лице Zy - Zy	131.99±6.90	124.404±7.744

Просечната вредност на висината на лицето и на ширината на лицето се повисоки кај мажите.

Вредности на лицев индекс од антропометриските мерења добиени од **55** индивидуи, споредени со вредности од фотограметриските мерења од истите испитаници.

Лицев индекс	Антропометрија	Фотограметрија
Mean	93.2182	93.2127
SD	6.7825	5.8594
SEM	2.0450	1.7667
N	55	55

t-вредноста е 0,00202. / p-вредноста е 0,499205.



Не постои статистички значајна разлика помеѓу двата методи на ниво на значајност од $p < .05$.

Фотографијата е финансиски исплатлива и доверлива метода за идентификација на мекоткивните точки и веродостојна за правење на анализи. Фотограметријата како метода за анализа на лицето на пациентот може ефикасно да се користи како алтернатива на антропометријата и да се интегрира во ортодонтската клиничка пракса.

“Life is like a camera. Just focus on what’s important and capture the good times, develop from the negatives and if things don’t work out, just take another shot.”



***Ви благодарам на
вниманието!!!***