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NEÜ YAYINEVİ

Measurement of Epidermis, Dermis, and Total Skin Thicknesses from Six Different Face Regions

Altı Farklı Yüz Bölgesinden Epidermis, Dermis ve Toplam Cilt Kalınlıklarının Ölçümü

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Öz

Amaç: Bu çalışmanın amacı, yüzün altı farklı bölgesinin epidermis, dermis ve toplam deri kalınlıklarının belirlenerek cilt kalınlığı haritası oluşturmaktır.
Hastalar ve Yöntem: Yaşları 30-80 arasında değişen 90 kadın ve 90 erkek hastanın yüz derisi, saçlı deri, alın, yanak, kulak, burun ve dudak bölgelerinden 9-10 mm sağlıklı doku içeren örnekler retrospektif olarak çalışmaya dahil edildi. Örnekler incelendi ve ışık mikroskobu altında mikrometre ile epidermis ve dermis kalınlıkları ölçüldü.
Bulgular: Çalışmaya alınan 90 kadın katılımcının 6 yüz bölgesinin epidermis kalınlıkları 65,91±14,44 µm ile 120,91 ±44,74 µm, dermis kalınlıkları 1150±217,43 µm ile 1498,33±388,56 µm ve toplam deri kalınlıkları 1234,83± 217,6 µm ve 1599,33±492,2 µm idi. Çalışmaya alınan 90 erkek katılımcının 6 yüz bölgesinin epidermis kalınlıkları 79,08±13,88 µm ile 122,75±32,5 µm, dermis kalınlıkları 1106,66±389,82 µm ile 1942,5±464,06 µm ve toplam deri kalınlıkları 1756±503,75 µm ve 2022,5±460,24 µm arasında bulundu.
Sonuç: Kadın hastalarda en ince epidermis saçlı deriden, erkek hastalarda ise en ince epidermis yanaktan ölçüldü. En kalın epidermis kadın ve erkek hastalarda üst dudak üstü bölgedeydi. Ancak dermis kalınlığının en ince ve kalın olduğu bölgeler cinsiyete göre farklılık gösterdi. Daha ileri çalışmalarda, daha çok merkezli, çok ırklı materyaller kullanılarak yüzün daha fazla alt birime bölünmesiyle yüz derisi kalınlığının tam bir haritası elde edilebilir.

Anahtar Kelimeler: Yüz derisi, deri, kalınlık, epidermis, dermis, histometrik

Abstract

Aim: The aim of this study was to map the skin thickness by determining the epidermis, dermis and total skin thickness of six different regions of the face.
Patients and Methods: Samples containing 9-10 mm of healthy tissue from the facial skin, scalp, forehead, cheek, ear, nose and lip regions of 90 female and 90 male patients aged between 30 and 80 years were retrospectively included in the study, and epidermis and dermis thicknesses examined with a micrometer under a light microscope.
Results: Epidermis thicknesses of 6 facial regions of 90 female participants included in the study were between 65.91±14.44 µm and 120.91±44.74 µm, dermis thicknesses were between 1150±217.43 µm and 1498.33±388.56 µm, and total skin thicknesses were between 1234.83±217.6 µm and 1599.33±492.2 µm. Epidermis thicknesses of 6 facial regions of 90 male participants included in the study were between 79.08±13.88 µm and 122.75±32.5 µm, dermis thicknesses were between 1106.66±389.82 µm and 1942.5±464.06 µm, and total skin thicknesses were between 1756±503.75 µm and 2022.5±460.24 µm.
Conclusion: In the female patients, the thinnest epidermis was measured on the scalp and the thinnest epidermis in the male patients was measured on the cheek. The thickest epidermis was on the upper lip in the male and female patients. However, the regions with the thinnest and thickest dermis thicknesses differed according to gender. In further studies, a full map of facial skin thickness can be obtained by dividing the face into more subunits using more multicentre, multiethnic materials.

Key words: Facial skin, skin, thickness, epidermis, dermis, histometric

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INTRODUCTION

The skin is one of the largest organs of the body with its many components and layers (1). It is frequently affected by external factors and surgical interventions. Thousands of studies are carried out in a wide variety of fields related to human skin. It is essential for these studies to know the vascular networks, other components and layers of the skin as well as its histological structure as a whole. In general, the histological structure of the skin has been known for many years, but another known fact is that the size and density of these components and layers are variable according to body regions (2).

Knowing the mean values of the epidermis and dermis thicknesses in different body parts of the skin is important for many applications to the skin, from laser to peeling, and from vaccination to intradermal injections. For this reason, measurement results with various techniques have been reported in many different studies in the literature (1-5).

Although biopsy is the gold standard for determining skin thickness, it is ethically inconvenient to take a biopsy from a healthy person (4). Although imaging techniques such as ultrasound and magnetic resonance (MR) can also provide data, they cannot provide precise objective results as in microscopic examination (2). Although skin thickness can be measured microscopically in studies performed on fresh cadavers, measurement of skin thickness from surgical materials taken from living people stands out as a method that can be standardized and conformed to ethical rules, due to the difficulties in obtaining cadavers and the inability to obtain sufficient number of preparations (4).

Knowing the thickness of the epidermis and dermis in many skin rejuvenation methods that work with the logic of creating damage to the skin can increase the efficiency after the procedure and reduce the complications that may develop. Although the skin thickness of various regions of the face of people in different geographical regions is reported in the literature, the skin thickness of the facial region of people living in Anatolia is not known.

The aim of this study was to map the skin thickness by determining the epidermis, dermis and total skin thickness of six different regions of the face.

PATIENTS AND METHODS

Patients who were operated for malignant skin tumors in the Plastic Surgery clinic between 2016 and 2021 were retrospectively scanned. Ethical approval was obtained from the Ethics Committee of Necmettin Erbakan University, Meram Faculty of Medicine (2022/3947). Materials containing at least 9-10 mm of healthy skin adjacent to the surgical margin, without lesions, were included in the study. Materials that did not have a sufficient length of solid area between the lesioned area and the surgical margin, and that appeared congested due to fixation problems or that contained crosssection artifacts were excluded from the study. The patients were contacted by phone and their height and body weights were questioned. Patients with a body mass index of 20-20 were included in the study, while patients defined as thin or obese were excluded.

Subunits were scanned separately for male and female patients by regionbased search from the computer system. Facial subunits in which the data of at least 30 patients, 15 female and 15 male, could be measured, were determined. Facial regions with fewer samples than this number were excluded from the study (Figure 1).

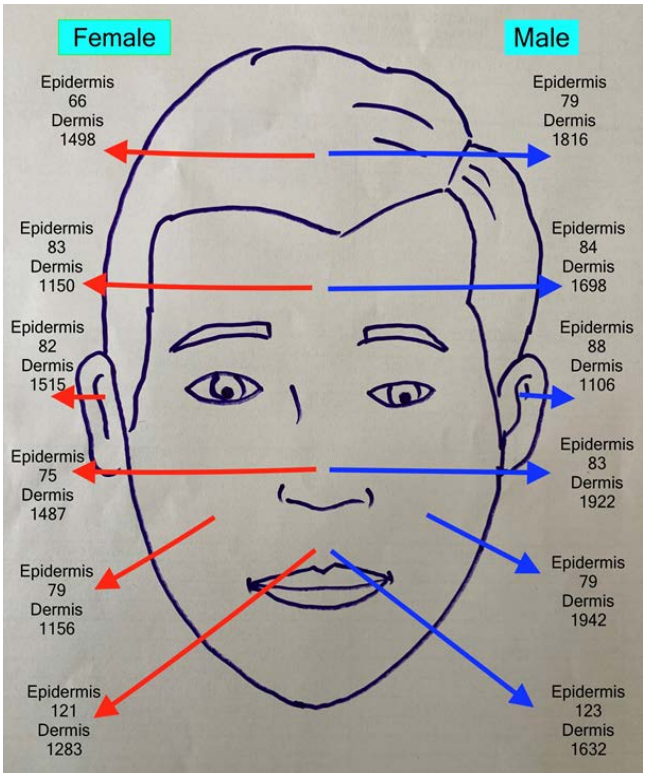

Figure 1. Epidermis and dermis thickness of the six regions in μm in female and male face skins; scalp, forehead, cheek, ear, upper lip and dorsum of the nose.

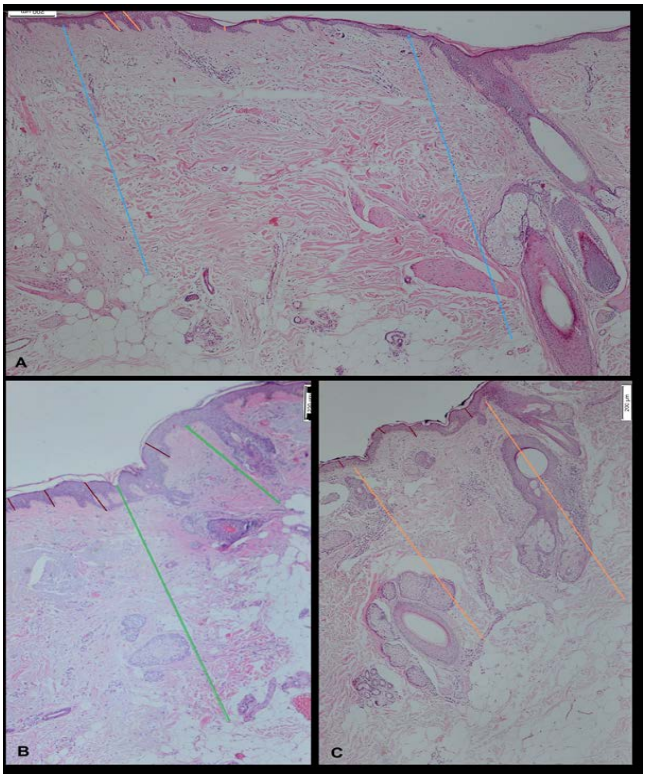

Figure 2. The mean dermis and epidermis and total skin thicknesses of each case were calculated by taking 4 measurements of different thicknesses for the epidermis and 2 measurements for the dermis, X40,H&E, A)Scalp B)Forehead C)Ear

H&E stained preparations of the listed materials were obtained from the archive of the Department of Medical Pathology.

The epidermis and dermis thicknesses of 15 skin tissues of male and female patients for each region were measured with a micrometer under an Olympus light microscope. The mean dermis and epidermis and total skin thicknesses of each case were calculated by taking 4 measurements of different thicknesses for the epidermis and 2 measurements for the dermis (Figure 2). All preparations were evaluated by the same pathologist and then checked by a second pathologist. Preparations with differences in measurements were excluded from the study.

Statistical Analysis

The mean, median, standard deviation, Q1 value and total skin thickness of epidermis and dermis thicknesses were calculated statistically using Microsoft Excel® (Microsoft Corporation, Redmond, Washington) program. Mean ± standard deviation values were evaluated for genders and regions.

RESULTS

In the study, the preparations of a total of 3584 patients were scanned. A total of 180 of these preparations meeting the criteria were included in the study. The six regions were evaluated because of the sufficient number of materials belonging to the scalp, forehead, cheek, ear, upper lip and dorsum of the nose on the facial skin. (Figure 1).

The mean age of the 90 female participants included in the study was 66. Epidermis thicknesses of the six facial regions ranged from 65.91±14.44 µm to 120.91±44.74 µm, dermis thicknesses ranged from 1150±217.43 µm to 1498.33±388.56 µm, and total skin thicknesses ranged between 1234.83±217.6 µm and 1599.33±492.2 µm. The thinnest epidermis was measured on the scalp, the thickest epidermis on the upper lip, the thinnest dermis on the forehead, and the thickest dermis on the ear skin. Total skin thickness was thinnest on the forehead and thickest in the ear (Table 1).

The mean age of the 90 male participants included in the study was 67. Epidermis thicknesses of the six facial regions ranged from 79.08±13.88 µm to 122.75±32.5 µm, dermis thicknesses ranged from

Table 1. Female epidermis, dermis and total skin thickness of six face regions

Female	Epidermis (µm)				Dermis (µm)				Total skin thickness (µm)			
	Mean	Median	SD	Q1	Mean	Median	SD	Q1	Mean	Median	SD	Q1
Forehead	83,83	75	24,84	66,25	1150	1150	217,43	1006,25	1234,83	1220	217,60	1087,50
Nose	75	70	18,80	57,50	1487,50	1375	505,12	1175	1563,50	1470	497,69	1262,50
Lip	120,91	117,50	44,74	80	1283,33	1250	447,08	981,25	1403,33	1360	446,32	977,50
Ear	82	75	20,45	63,75	1515	1537,50	486,28	1256,25	1599,33	1620	492,20	1315
Scalp	65,91	63,75	14,44	61,25	1498,33	1425	388,56	1275	1564,83	1487,50	387,77	1340
cheek	78,83	80	24,44	61,25	1155,83	1225	356,84	968,75	1244,66	1282,50	355,40	1005

Table 2. Male epidermis, dermis and total skin thickness of six face regions

Male	Epidermis (µm)				Dermis (µm)				Total skin thickness (µm)			
	Mean	Median	SD	Q1	Mean	Median	SD	Q1	Mean	Median	SD	Q1
Forehead	84,25	85	21,42	68,75	1698,33	1625	514,27	1368,75	1784,83	1707,50	512,61	1332,50
Nose	83,16	82,50	18,53	72,50	1922,50	1762,50	535,92	1531,25	2009,98	1870	525,11	1577,50
Lip	122,75	121,25	32,5	97,50	1631,66	1687,50	512,41	1399,37	1756	1772,50	503,75	1457,50
Ear	87,91	83,75	28,31	66,25	1106,66	1100	389,82	800	1200,33	1215	387,65	857,50
Scalp	79,41	76,25	17,04	66,25	1815,83	1850	432,71	1537,50	1899,83	1960	432,63	1510
Cheek	79,08	72,50	13,88	66,25	1942,50	1900	464,06	1731,25	2022,50	1977,50	460,24	1722,50

1106.66±389.82 µm to 1942.5±464.06 µm, and total skin thicknesses ranged from 1756±503.75 µm to 2022.5±460.24 µm. The thinnest epidermis was on the cheek area, while the thickest epidermis was on the upper lip. The thinnest dermis was measured on the ear skin, and the thickest dermis on the forehead skin. The thinnest total skin thickness was measured at the ear, while the thickest area was at the cheek (Table 2).

The areas with the thickest epidermis thicknesses were the same in the male and female patients. However, the regions with the thinnest and thickest dermis thicknesses differed according to gender.

DISCUSSION

The epidermis, dermis and total thicknesses of the skin may vary according to body regions, age, gender and even geographical region and ethnic origin (2-9). Knowing the measurement values of skin layers is important for many scientific studies, treatment applications, oncological staging and evaluation studies, in vitro skin models, some surgical techniques and reconstruction applications (3,4,6-13).

There are studies measuring facial skin thicknesses in the literature (2-5). Most of the studies were conducted using noninvasive but costly methods such as computed tomography (CT), magnetic resonance imaging (MRI), ultrasonographic (USG) evaluation and confocal microscopy, and histometric and invasive methods using cadaver skin, autopsy materials, or punch biopsy materials applied to living humans (3,7,9-12,17-19). The diversity of measurement methods causes a lack of standardization. MRI and CT are expensive techniques for measuring skin thickness and cannot provide as detailed information as microscopic examinations. There is a risk of radiation exposure with CT and a subjective assessment risk with USG (7,15). Confocal microscopy instrumentation methods can provide accurate measurements, but are still under development (15,17). There are studies measuring breast skin thickness on filmscreen mammograms in women (20). Although this method is also inexpensive and noninvasive, it is not a suitable method for measuring whole body skin areas due to direct exposure to radiation. The methods other than histometric measurement may not allow to measure epidermis and dermis thicknesses separately and it may be difficult to establish standardization.

In the method we defined, intact skin parts of retrospective surgical materials are used and it reflects the results of living people with an ethical method. We think that the values obtained by this method are more standardized than the values obtained from autopsy or other methods. On the other hand, data on thousands of patients can be obtained using this technique. Comparative studies on this subject can contribute to the literature.

In studies measuring facial skin thicknesses (3,7,10,18,21), it is seen that values obtained by USG are used, as well as histometric methods obtained from punch biopsy and cadaver. To the best of our knowledge, a study that measures the epidermis, dermis and total skin thicknesses of various parts of the facial skin histometrically as a whole was not found in the literature. In a study of Lee et al., in which the skin thickness of Korean adults was measured using punch biopsy materials, skin thicknesses of several facial regions such as the eyelid and chin were reported, and it is seen that the measurements in the facial region were limited to 2-3 regions due to the invasiveness of the method (3). On the other hand, the number of specimens measured in these regions varied between 6 and 14. Whereas, in our study, more reliable data were obtained by examining

15 specimens for each region. In this study, it was reported that the mean thickness of the epidermis and dermis at the forehead region were 93.6 and 788 μm. In our study these thicknesses were 84 and 1424 μm. They reported that the mean thickness of the epidermis and dermis at the cheek region were 98.2 and 1076 μm. In our study these thicknesses were 79 and 1562 μm. In both regions, the thickness of the epidermis of the Turkish people was thinner than that of the Korean society, and it is seen that the thickness of the dermis was much higher. We could not compare the skin thicknesses of the other regions we measured in our study, since we could not find any studies that measured different ethnic origins.

In a study, a significant relationship was reported between dermis thickness and hypertrophic scar (6). According to the data obtained in our study, it can be thought that there will be more scars in areas with high dermis thickness in men and women. When evaluated from this point of view, it can be thought that most of the incisions in men will be on the forehead. Incisions to be made parallel to the forehead lines can eliminate this disadvantage.

The limitations of our study are that the facial skin is limited to some main regions and the average age is high. However, this is due to the fact that we use the available archive data. Further studies to be conducted in large centers where the excision materials of facial skin lesions are much more or multicenter studies can provide contribution to the literature.

In many studies in the literature, it has been reported that the thinnest skin on the face is in the eyelid (3, 23). Although this region was not examined in our study, it was observed that the thinnest epidermis was on the cheek in men among the examined regions. In procedures such as laser, peeling, dermabrasion to the cheek area of men, performing the procedure more superficial than other parts of the face can reduce possible hyperpigmentation. In both sexes, the processes that damage the epidermis on the upper lip, where the thickest epidermis is determined, can be performed deeper than the other regions.

The thickness of the epidermis and dermis we determined in our study is quite different from the studies in the literature. In particular, the application depth to be determined in rejuvenation methods that work with the logic of damaging the upper layers of the skin should be chosen in different thicknesses according to each society. Otherwise, the possibility of encountering unwanted complications such as hyperpigmentation or scarring may increase.

In further studies, a full map of facial skin thickness can be obtained by dividing the face into more subunits using more multicentre, multiethnic materials.

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