



Original article

Ultrasound evaluation of normal orbital preseptal thickness

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Abstract

Introduction: Orbital preseptal thickness is an important parameter not only in diagnosis of orbital cellulitis but also in recent classification and management of dark eye circle (DEC). **Objective:** The aim of this study was to evaluate normal preseptal thickness and collect baseline data in normal skin in a given population with no orbital pathology. **Materials & method:** Ultrasound was performed on 42 patients (23 females and 19 males) with clinically normal eyes and orbits for evaluation of normal orbital preseptal thickness. The age ranged between 15 to 35 years with a mean age of 24.9 years. **Results:** Our study concluded that normal preseptal thickness ranged from 2.1 mm to 5.5 mm. Mean preseptal thickness for both sides was 3.9 mm. **Conclusion:** Ultrasound can be used as quick, reliable and cost-effective modality for evaluation of orbital preseptal thickness.

Keywords: Ultrasonography, orbital preseptal thickness

Introduction

Ultrasound is a non-invasive tool for examining the normal upper and lower eyelid structures and anatomic compartments. Anatomic changes associated with periocular and orbital diseases such as blepharoptosis, eyelid lesions, and even thyroid-associated orbitopathy have also been successfully characterized with ultrasonography (Hosal et al, 2004; Lee et al, 2006; Kikkawa et al, 2003; Furuta et al, 2007; Bajaj et al, 2007; Given-Wilson et al, 1989). Also, it can be used as an aid to set up a assessment score for better classification

of DEC (Huang et al, 2014). However, no studies establishing a baseline normal value of preseptal thickness evaluated by ultrasound has been found.

The preseptal area is the region located anterior to the septum orbitale that separates the intraorbital fat from the orbis ocularis muscle. It is measured from the arcus marginalis to the skin, and is helpful in determination of periorbital puffiness.

In this paper we try to establish a baseline normal value of the preseptal thickness.

Materials & Methods

This prospective study was conducted for a period of 1 month (January 15th 2017 to February 15th 2017). A total of 42 patients (23 females and 19 males) examined by a

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dermatologist who were clinically diagnosed to have normal orbital morphology & skin textures were enrolled into the study. Exclusion criteria included presence of orbital cellulitis, puffiness, infraorbital palpebral bags and any form of DEC. Ultrasound images of subjects with ages ranging from 16 to 33 years were analyzed. Ultrasonographic evaluation was performed by single radiologist with more than 8 years of experience in ultrasonography. High frequency linear transducer of 11 MHz (Toshiba Nemio XG) was used. The patients were placed in supine position with eyes closed. The probe was placed perpendicular to the area of interest and the lower eyelid compartments were visualized in the mid sagittal plane and inferiorly to the orbital rim. Examination was performed on both sides. The line from the inferior part of the tarsus to the arcus marginalis was the anatomic neutral position of the orbital septum (Jones 1976; Jones 1970; Montandon et al, 1990; Levine 1996). The thickness of the preseptal area was measured from the skin surface to the arcus marginalis. The arcus marginalis was identified as a thick short horizontal echogenic band just superficial to the bony rim and tarsus muscle was seen as a thin hypoechoic horizontal band just deep to the orbicularis oculi muscle. The orbicularis oculi muscle exhibited mixed echogenicity deep to the skin. Usually, the infraorbital fat pad showed hyperechoic signals (Figure. 1). The preseptal thickness of normal individuals was tabulated for each and both sides using Microsoft Excel was used to calculate mean and range (Table 1). Statistical significance according to age and gender was calculated using Chi-square test (p value < 0.001)

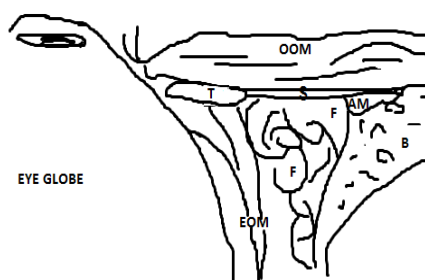
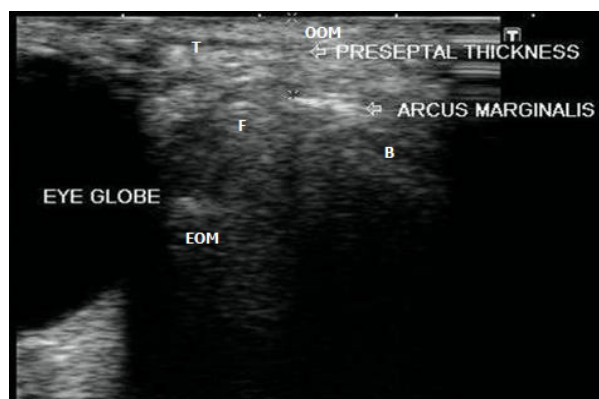


Figure 1: Schematic representation (bottom) shows anatomic structures of the lower eyelids and orbit compared with ultrasonography (top). AM, arcus marginalis; B, orbital bone; F, infraorbital fat pad; EOM, extraocular muscle; OOM, orbicularis oculi muscle; S, orbital septum; T, tarsus. Region between the calipers is preseptal thickness.

Results

Age of the patients ranged from 15 to 35 years. The mean age of female patients was 23.8 years and that of male patients was 26.2 years. Normal preseptal thickness ranged from 2.1 mm to 5.5 mm. The mean preseptal thickness in male patients was 3.93 mm in right and 3.93 mm in left side. The mean preseptal thickness in female patients was 3.93 mm in right and 3.98 mm in left side. The mean preseptal thickness in both gender and all ages was 3.93 mm in right, 3.94 mm in left side and cumulative mean of both sides was 3.93 mm. There was no statistically significant difference in the preseptal thickness when compared between right and left side, gender and age group.

Table 1: M = Male, F = Female

Patients Serial Number	Gender	Age (years)	Preseptal thickness (mm)	
			Right	Left
1.	F	24	4.7	5.0
2.	F	32	4.1	4.2
3.	F	26	4.2	4.3
4.	M	27	4.7	4.0
5.	F	33	4.6	4.5
6.	F	23	4.5	5.0
7.	M	18	2.5	2.6
8.	F	31	5.5	4.5
9.	M	24	4.6	4.4
10.	M	32	2.9	3.3
11.	F	26	3.5	3.6
12.	M	29	3.2	3.0
13.	M	30	4.2	4.4
14.	F	21	4.5	4.8
15.	M	35	3.6	3.8
16.	F	15	4.0	4.2
17.	F	26	3.7	3.9
18.	M	23	4.5	5.0
19.	M	29	4.2	4.2
20.	F	16	3.5	3.6
21.	F	23	4.8	5.0
22.	M	25	5.0	5.1
23.	M	26	4.0	4.3
24.	M	21	3.8	2.6
25.	F	22	2.8	2.6
26.	F	22	3.8	3.7
27.	M	24	4.2	4.4
28.	M	22	3.4	3.1
29.	M	22	3.7	3.9
30.	M	23	2.6	2.3
31.	F	23	3.5	3.7
32.	F	18	3.8	4.1

33.	M	33	5.1	4.8
34.	F	20	3.9	4.3
35.	F	17	4.5	4.7
36.	M	24	4.6	4.7
37.	F	26	2.1	2.6
38.	F	26	3.6	3.8
39.	M	32	4.0	4.8
40.	F	29	3.8	3.8
41.	F	34	4.0	3.6
42.	F	15	3.0	2.2

Discussion

Ultrasonography is a quick & reliable technique for evaluating the anatomical structures of the lower eyelid compartments. Although MRI provides excellent tissue contrast and detailed anatomy of septum orbitale (Hoffmann et al, 1998), ultrasound is also a reliable technique for evaluating the anatomical structures; also it is more cost effective and readily available. In this study ultrasound was able to identify all the relevant infra-orbital anatomic structures as described in other studies. Our study provides a baseline value of preseptal thickness in non - pathological orbits. Based on these values, one can postulate that changes in preseptal thickness could either relate to pathological or surgical changes.

Our study is just a prefatory evaluation of the application of ultrasound in assessing few of the structures of the lower eyelid. Further evaluation of its diagnostic precision is suggested with investigation of a larger number of healthy and diseased subjects.

Conclusion

Ultrasound is a quick, accurate and readily available tool for evaluating the periorbital region. This study also emphasizes its potential for assessing the anatomic and physiological characteristics in a variety of disorders, post-surgical structural changes, evaluation of pigmentary disorders and as a pre-evaluation

tool during cosmetic surgery are potential fields for its application.

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