·Clinical Research·

Comparison of the Schirmer Ⅰ test with and without topical anesthesia for diagnosing dry eye

Na Li, Xin-Guo Deng, Mei-Feng He

State Key Laboratory of Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou 510060, Guangdong Province, China

Correspondence to: Xin-Guo Deng. State Key Laboratory of Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou 510060, Guangdong Province, China. dengxg61@163.net

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Abstract

• AIM: To determine the value of Schirmer Ⅰ test (SⅠt) without anesthesia and with topical anesthesia for diagnosing dry eye (DE).

• METHODS: Totally 220 eyes in 110 patients, male (44) and female (66), (39.56±12.67) years old diagnosed with DE were examined. SⅠt without anesthesia was performed firstly, and 15 minutes later, it was applied again in the same person after topical anesthesia with 0.5% proparacaine hydrochloride eye drops. The wetting strips counted <10mm per 5 minutes were defined positive, while ≤5mm per 5 minutes were defined strong positive.

• RESULTS: The wetting length in SⅠt after topical anesthesia was significantly lower than that in SⅠt without anesthesia ($P<0.001$). The positive rate and strong positive rate of SⅠt after topical anesthesia were significantly higher than that of SⅠt without anesthesia ($P<0.001$). The positive rate and strong positive rate of SⅠt without anesthesia and the strong positive rate of SⅠt after topical anesthesia in patients with aqueous-deficiency dry eye (ADDE) were significantly higher than those in total patients whereas those in patients with evaporative dry eye (EDE) were significantly lower than those in total patients ($P<0.001$).

• CONCLUSION: SⅠt after topical anesthesia with 0.5% proparacaine hydrochloride eye drops is more objective and reliable than that without anesthesia in reflecting the status of DE, and its diagnostic value in patients with ADDE was even higher, making itself a meaningful evidence for the diagnosis and treatment of DE.

• KEYWORDS: dry eye; Schirmer Ⅰ test; tears; topical anesthesia

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INTRODUCTION

Dry eye (DE), also known as keratoconjunctivitis sicca (KCS), is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tears film instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface [1]. In recent years, with the development of living standard, popularity of computers and impact of environment etc, the morbidity of DE is increasing annually. Considering the complicated etiology, the international dry eye workshop (DEWS) divided DE into aqueous-deficiency dry eye (ADDE) and evaporative dry eye (EDE) [1]. Both forms have further subbranches. For example, diseases such as Sjögren syndrome (SS) and other lacrimal diseases fall under ADDE, whereas meibomian gland dysfunction (MGD) [2,3], wearing contact lens[4] and blink abnormalities[5] are subdivisions of EDE[1].

The diagnosis of DE is mainly based on clinical features and some diagnostic tests such as corneal fluorescein staining (examining the tear break-up time (BUT) and ocular surface damage), tear meniscus height, Schirmer Ⅰ test (SⅠt), rose bengal staining, and so on. Nowadays, SⅠt is the popular test for assessment of tear production. In SⅠt without anesthesia, the positive results can be one of diagnosis standards, whereas the negative results can only be a reference, for its high false negative rate makes results lower reliability [6-8]. However, recently, we found that SⅠt after topical anesthesia with 0.5% proparacaine hydrochloride eye drops had high correspondence with the diagnosis of DE, so we aimed to determine the value of SⅠt in the diagnosis of DE by comparing SⅠt without anesthesia and with topical anesthesia with 0.5% proparacaine hydrochloride eye drops.

SUBJECTS AND METHODS

Subjects Totally 220 eyes of 110 patients who were diagnosed with DE from October 2010 to December 2010 in Zhongshan Ophthalmic Center were recruited for the study. There were 44 males and 66 females with an average age of 39.56 years. Informed human consent was obtained prior to

undertaking the study, adhering to the tenets of the Declaration of Helsinki. Inclusion criteria for DE, which we modified according to Liu and Peng[9] were as follows: more than two symptoms of DE (Table 1) in each patient; tear film BUT ≤3 seconds; minimum of 3 punctation on cornea by corneal fluorescein staining; no evidence of other external ocular disease.

Methods

S Ⅰ t Without previously instilling anesthetic drops, the schirmer strips (Tianjin Jingming New Technological Development Co., Ltd, China) were inserted into the lower conjunctival sac at the junction of the lateral and middle thirds, avoiding touching the cornea, and the length of wetting strips in millimeters was recorded after 5 minutes. 15 minutes later, strips were placed over the same point in the same person again for 5 minutes, after topical anesthesia with 0.5% proparacaine hydrochloride eye drops (Alcon laboratories Inc., s.a. Alcon-Couvreur n.v.) twice at 1 minute interval, and then the length of wetting was read. The tests above were administered by the same person at the same time and the same place. All patients were seated at rest with their eyes closed, and the lower cul-de-sac was gently dried with a cotton applicator before the placement of strips.

Classification criterion of ADDE And EDE According to classification of DE by DEWS [1], EDE patients (n=42) in our study only involved meibomian gland dysfunction. Diagnostic criteria of meibomian gland dysfunction was mainly based on observation under the slit-lamp microscope [10-12]: expressed secretion are reduced or excessive when the glands are oppressed, taking on frothy or more viscous changes. In some cases, there is meibomian orifice hyperkeratosis, plugging or even obstruction. The above changes are always followed by lid margin hyperemia and telangiectasia. ADDE patients (n=68) involved only SS (n=8) and reflex hyposecretion (n=60).

Statistical Analysis The data were presented as the mean± standard deviation (SD). Statistical analysis was performed using SPSS version 16.0 (SPSS, Inc., Chicago, IL). Comparison of the positive rate and strong positive rate among groups was analyzed with paired Chi-square test or Fisher's exact probabilities while paired-sample t test was chosen to compare the wetting length of S Ⅰ t without anesthesia and with topical anesthesia. Significance level was set at P<0.05.

RESULTS

The wetting strips counted <10mm were defined to be positive, while ≤5mm were defined to be strong positive. Paired-sample t test showed that the wetting length of S Ⅰ t after topical anesthesia in ADDE patients, EDE patients or in all patients was significantly lower than that of S Ⅰ t without anesthesia (P<0.001, Figure 1).

Table 1 Symptoms of DE and their percentage in ADDE, EDE and in all patients respectively n(%)

Parameters	ADDE	EDE	All
Dryness	114(83.82)	64(76.19)	178(80.09)
Asthenopia	96(70.59)	68(80.95)	164(74.55)
Foreign body sensation	96(70.59)	38(45.24)	134(60.91)
Photophobia	80(58.82)	48(57.14)	128(58.18)
Blurred vision	78(57.35)	40(47.62)	118(53.64)
Itching	66(48.53)	34(40.48)	100(45.45)
Pain	64(47.06)	30(35.71)	94(42.73)
Redness	54(39.71)	34(40.48)	88(40.00)
Burning sensation	38(27.94)	20(23.81)	58(26.36)
Lots of discharge	24(17.65)	16(19.05)	40(18.18)
Lachrymation	24(17.65)	14(16.67)	38(17.27)
Hardness to open eyes	4(2.94)	4(4.76)	8(3.64)

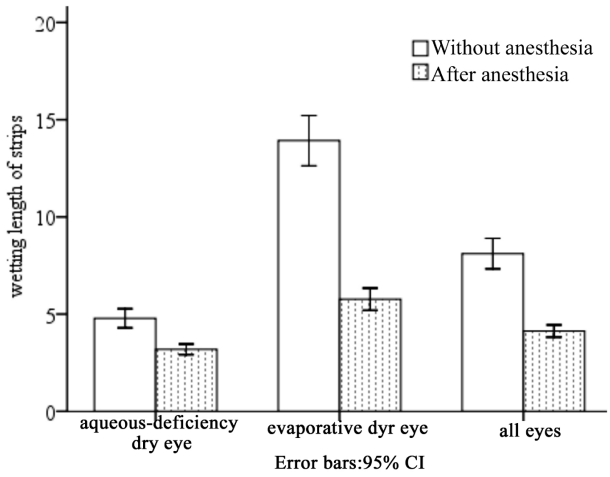

Figure 1 Wetting length of S Ⅰ t after topical anesthesia in ADDE patients, EDE patients or in all patients was significantly lower than that of S Ⅰ t without anesthesia, P< 0.001.

The positive rate and strong positive rate of S Ⅰ t after topical anesthesia in ADDE patients, EDE patients or in all patients were significantly higher than that of S Ⅰ t without anesthesia (P<0.001). In S Ⅰ t without anesthesia, the positive rate and strong positive rate in patients with ADDE were significantly higher than those in total patients whereas the positive rate and strong positive rate in patients with EDE were significantly lower than those in total patients. In S Ⅰ t after topical anesthesia, the strong positive rate in patients with ADDE was significantly higher than that in total patients while the strong positive rate in patients with EDE was significantly lower than that in total patients (P< 0.001, Figures 2, 3).

DISCUSSION

Our study showed that S Ⅰ t after topical anesthesia with 0.5% proparacaine hydrochloride eye drops was more objective and reliable than that without anesthesia in reflecting the status of DE, and its diagnostic value in patients with ADDE was even higher.

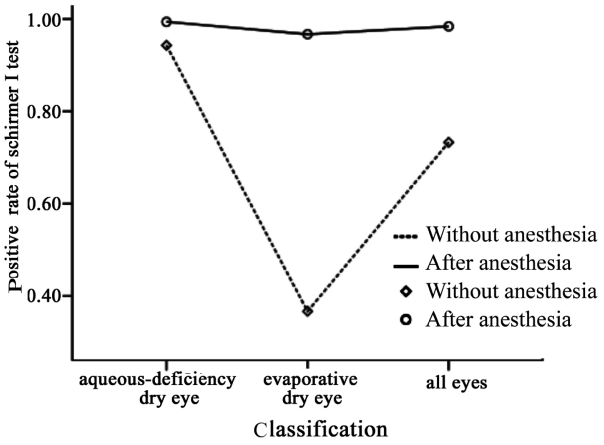

Figure 2 Positive rate of S Ⅰ t after topical anesthesia in ADDE patients (*n*=68), EDE patients (*n* =42) or in all patients (*n*=110) were significantly higher than that of S Ⅰ t without anesthesia, *P*<0.001.

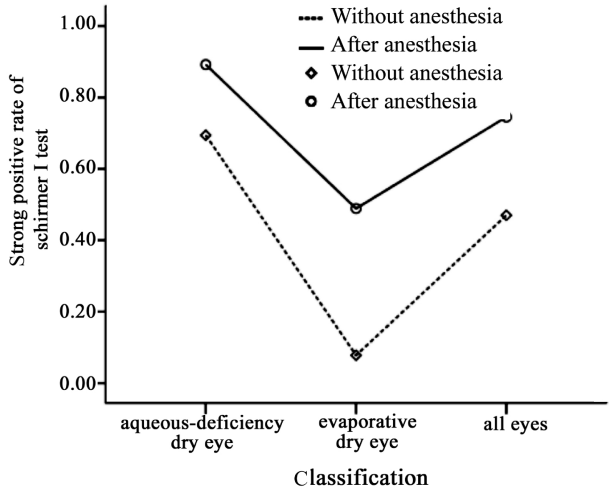

Figure 3 Strong positive rate of S Ⅰ t after topical anesthesia in ADDE patients (*n*=68), EDE patients (*n*=42) or in all patients (*n*=110) were significantly higher than that of S Ⅰ t without anesthesia, *P*<0.001.

DE is a common chronic inflammatory disease in ocular surface, characterized by abnormity of tear film. The reported prevalence of DE ranged from 4.3% to 73.5% for variations of selected objects or diagnostic criteria. The incidence was more prevalent in women and increased with age [13-15]. Its clinical symptoms are various from minor discomfort to dryness, foreign body sensation, asthenopia, photophobia, pain, *etc*., even to hardness to open eyes or eyesight reduction, which severely influence the quality of life for each patient [16-18]. Nowadays, there is still no consensus on the diagnosis of DE.

The low cost and simplicity of schirmer test makes itself the most commonly used Screening test for assessment of tear production, named after schirmer who brought the test forward for the first time in 1903. Schirmer test was divided into Schirmer Ⅰ test and Schirmer II test. Schirmer II test is performed by irritating the nasal mucosa with a cotton-tipped applicator prior to measuring tear production, which is mainly used for measuring the reflex tear secretion of main lacrimal gland. S Ⅰ t has two branches: S Ⅰ t without anesthesia and with topical anesthesia. When performed without anesthesia, the S Ⅰ t measures the basal tear secretion and the function of the main lacrimal gland whose secretory activity is stimulated by the irritating nature of the filter paper. S Ⅰ t performed after topical anesthesia measures the function of the basal lacrimal secretion [19,20]. The critical value for diagnosis has not yet been unified. Vitali *et al* [21] and van Bijsterveld[22] defined anomaly area of S per 5 minutes t without anesthesia to be <10mm per 5 minutes and ≤5.5mm per 5 minutes respectively and a cutoff ≤5.0mm per 5 minutes is always recommended currently[1,7]. Jones[23] presented that the cut-point of basal S Ⅰ t should be set at 10mm per 5 minutes.

The value of S Ⅰ t in the diagnosis of DE has been in debate for its high false negative rate. Saleh *et al* [6] reported that there only was 38.83% DE patients <10mm per 5 minutes while 24.27% patients ≤5mm per 5 minutes when performed S Ⅰ t without anesthesia. Danjo[7] showed that the value of S Ⅰ t without anesthesia in 72.15% definite DE patients was <10mm per 5 minutes while 65.82% patients ≤5mm per 5 minutes. Nichols *et al* [8] believed that S Ⅰ t without anesthesia displayed lower credibility, but the credibility elevated in moderate and severe DE patients. Our results showed that the positive rate and strong positive rate of S Ⅰ t without anesthesia are 70.90% and 48.80% separately, also displaying a low credibility. The low sensitivity may be related with the following factors: 1) The sensory nerves in ocular surface are very sensitive, resulting in great response to stimuli if the S Ⅰ t were performed without anesthesia; 2) Other factors such as the state of patients, location of strips, dryness of remaining fluid in the eyes or not, with eyes open or closed in case of influence from the environment condition or the rate of blinking [24,25], varieties of topical anesthetic [26] and so on. In our study, 15 minutes after the test without anesthesia, when S Ⅰ t was performed after anesthesia with 0.5% proparacaine hydrochloride eye drops in the same person, the positive rate and strong positive rate hit 98.20% and 72.70% respectively, showing a rather high correspondence with DE. We believed that it was relevant to anesthesia of ocular surface and avoidance of correlative influencing factors. Besides, our results showed that the strong positive rate in patients with ADDE, whether it was anesthetized or not, were significantly higher than those in total patients whereas the strong positive rate in patients with EDE were significantly lower than those in total patients. This is chiefly because that EDE is characterized by GMD and excessive evaporation, whose tear production is always less affected.

Studies[27,28] showed that SⅠt was widely used in clinic, so it is very important to test it correctly. According to our results, we believe that SⅠt after topical anesthesia with 0.5% proparacaine hydrochloride eye drops is a meaningful evidence for the diagnosis and treatment of DE.

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