

SCIENTIFIC REPORT

Efficacy of pressure topical anaesthesia in punctal occlusion by diathermy

R W K Law, R T H Li, D S C Lam, J S M Lai

Br J Ophthalmol 2005;89:1449–1452. doi: 10.1136/bjo.2005.066969

Aims: To prospectively compare the efficacy and safety of pressure topical anaesthesia in punctal occlusion by using cautery in the treatment of dry eye syndrome (DES) with that of conventional treatment by using needle injection of anaesthetic agents.

Methods: In a randomised controlled trial, 18 consecutive adult patients with DES requiring punctal occlusion were recruited over a 10 month period. Consenting patients were randomised into two groups. Group A patients received pressure topical anaesthesia in the right eye followed by injection anaesthesia in the left eye. Group B was vice versa. Punctal occlusion using cautery was performed in each eye after a specified time following the application of anaesthesia. The main outcome measures were the pain experienced during application of anaesthesia and that during punctal occlusion.

Results: 36 eyes of 18 patients were randomised to receive injection anaesthesia in one eye and pressure topical anaesthesia in the other. Nine patients (nine females) were in group A and nine patients (seven females, two males) in group B. The mean age of group A patients was 45.3 (SD 13.5) years, and that of group B patients was 55.6 (12.6) years. The two groups were comparable in terms of mean age ($p=0.117$) and mean pain score for pressure topical anaesthesia application ($p=0.612$), injection anaesthesia application ($p=0.454$), diathermy in pressure anaesthetised eyes ($p=0.113$), and diathermy in injection anaesthetised eyes ($p=0.289$). Paired *t* test was used to compare the mean pain score for pressure topical anaesthesia application (16.8 (24.8)) with those for injection anaesthesia application (56.7 (30.0)). 18 eyes of 18 patients were compared with the fellow eye of the same 18 patients. The mean pain score for injection anaesthesia was greater than for pressure topical anaesthesia application ($p<0.0001$) (statistical power=0.87). No statistically significant difference was found in the mean pain score for diathermy for eyes that received pressure topical anaesthesia (20.5 (27.5)) compared with eyes that received injection anaesthesia (23.1 (26.3)) ($p=0.760$) (statistical power=0.96). All 18 patients preferred pressure topical anaesthesia to injection anaesthesia.

Conclusion: Injection anaesthesia for punctal occlusion is more painful than pressure topical anaesthesia application. However, the pain experienced during diathermy application for punctal occlusion is similar between pressure anaesthetised eyes and injection anaesthetised eyes. Pressure topical anaesthesia is a less painful (in terms of anaesthesia application) but equally effective alternative to conventional injection anaesthesia when used for punctal occlusion.

Dry eye is a disorder of the tear film caused by tear deficiency or excessive tear evaporation, which causes damage to the interpalpebral ocular surface and is associated with symptoms of ocular discomfort.¹ Dry eye syndrome (DES) and its treatment are important because it is a frequently encountered clinical entity, especially with the extensive use of contact lenses in our population.

DES can cause considerable discomfort, such as burning, itching, foreign body sensation, stinging, dryness, photophobia, ocular fatigue and redness, some of the symptoms severe enough to interfere with normal daily functioning. Consequences of DES² can vary from minor inconvenience to more severe complications such as corneal epitheliopathy, filamentary keratitis, keratinisation, and rare but sight threatening complications like conjunctival and corneal squamous metaplasia, infectious keratitis, corneal ulceration, thinning, and perforation.

Current treatment is mainly by supplementation, stimulation, or preservation of aqueous tears. Although punctal occlusion by cautery is a relatively invasive treatment with its shortcomings, it is considered to be an important treatment strategy because of its long lasting effect. It retards tear drainage, thereby increasing tear volume on the ocular surface and lowering tear osmolarity. It is usually done after the use of temporary occlusion before permanent occlusion to rule out the possibility of creating epiphora. The procedure is fast, cheap, and can be easily performed as an office procedure.

Conventionally, anaesthesia is achieved by injection of local anaesthetic into the medial eyelid near the tear drainage system. Complications associated with the injections may include bleeding from the injection site, haematoma formation, and ocular damage if the injection penetrates through the eyeball. The injection of local anaesthetic solutions is frequently a painful and unpleasant experience for patients.³ Infiltration of the skin and subcutaneous tissues with local anaesthetic solutions produce pain and a burning discomfort,^{4,5} which is often severe enough to be the most unpleasant part of a minor surgical procedure.

As topical anaesthesia avoids the use of needles for injection, it is potentially a safer alternative to injection anaesthesia. However, it is generally regarded that a topical application of anaesthetic eye drops alone may not provide adequate anaesthetic effect for the deep burning pain associated with cautery of the punctum. We have demonstrated the usefulness of 2% Xylocaine gel in chalazion surgery,⁶ but our experience using 2% Xylocaine gel in punctal occlusion by cautery revealed poor tolerance. We hence try to improve the effectiveness of our method of anaesthesia by studying the effect of pressure topical anaesthesia using a cotton tipped applicator soaked with anaesthetic solution placed over the punctum between the

Abbreviations: DES, dry eye syndrome

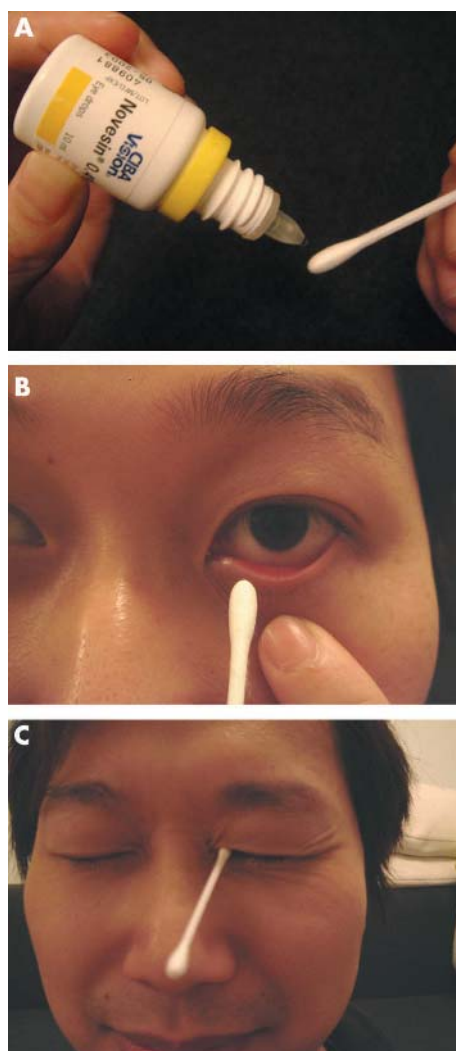


Figure 1 (A) Application of benoxinate eye drop solution with a cotton tipped dress applicator. (B) The benoxinate soaked dress applicator is placed over the left lower lid punctum. (C) The patient is asked to close the eye voluntarily. The dress applicator is kept in place for 5 minutes. (Photographs reproduced with patients consent.)

upper and lower lid under the pressurised effect of voluntary lid closure.

MATERIALS AND METHODS

Previous approval of the study protocol by the ethics committees of the United Christian Hospital was obtained. Patients with bilateral dry eyes (diagnostic criteria included: (a) symptoms and signs of DES and, (b) treatable causes of DES removed or corrected—for example, lipid tear abnormality as a result of blepharitis and lid abnormality causing evaporative dry eye, and (c) positive ancillary testing: fluorescein tear break up time <10 seconds and basal secretion test⁷ <5 mm) requiring punctal occlusion at United Christian Hospital were recruited. The study period was from February to November 2004. Other inclusion criteria were: (1) age over 18 years, (2) able to give informed consent, and (3) cooperative enough for punctal occlusion surgery under pressured or injection anaesthesia. Exclusion criteria were: (1) ocular or systemic conditions which are painful or require the regular use of analgesics; (2) medical, psychological, and social conditions predisposing to a different perception of pain.

Patients who fulfilled the criteria and agreed to be randomised for the study signed an informed consent. The patients were then randomised into one of two treatment groups using random number table. Group A patients received pressure topical anaesthesia in the right eye followed by injection anaesthesia in the left eye. Group B patients received injection anaesthesia in the right eye followed by pressure topical anaesthesia in the left eye. Neither the ophthalmologists recruiting the patients nor the patients were aware of which treatment group to join at the point of recruitment.

For all recruited patients, documentation of visual acuity, fluorescein tear break up time, and basal secretion test were performed in each eye. One drop of topical Novesin (benoxinate 0.4%, Novartis Pharmaceuticals Ltd) is instilled into each eye before receiving pressure or injection anaesthesia.

For group A patients, a cotton bud soaked in topical benoxinate (one drop, approximately 0.1 ml) is placed over the right lower lid punctum and the patient is asked to close the eye voluntarily and keep the cotton bud in place for 5 minutes (fig 1). After 30 seconds, punctal occlusion by diathermy is then performed for the right lower lid punctum. A volume of 0.1 ml of warm (room temperature) 2% lignocaine solution is then injected subcutaneously and slowly in 5 seconds within 0.5 cm of the left lower lid punctum. Punctal occlusion by diathermy is then performed for the left lower lid punctum, also after 30 seconds.

For group B patients, 0.1 ml of 2% warm lignocaine solution is injected subcutaneously in 5 seconds within 0.5 cm of the right lower lid punctum. After 30 seconds, punctal occlusion by diathermy is then performed for the right lower lid punctum. A cotton bud soaked (0.1 ml) in topical benoxinate is placed over the left lower lid punctum and the patient is asked to close the eye voluntarily and keep the cotton bud in place for 5 minutes. Punctal occlusion by diathermy is then performed for the left lower lid punctum after 30 seconds.

Postoperatively, the patient was questioned by an independent trained interviewer. Using visual analogue scales^{8–10} the patient was asked to give a pain score for anaesthesia application and punctal occlusion by diathermy for each eye. The visual analogue scale was 0–100, with a score of zero represented no pain at all and a score of 100 represented the worst pain ever. The patient was asked to put a cross on the 0–100 visual analogue scales. The patient was also asked which method of anaesthesia they preferred. At 3 months postoperatively, the patients were seen again at our clinic to review the patency of the punctum. Fluorescein tear break up time and basal secretion test are repeated, and symptoms of dry eyes are evaluated.

RESULTS

During the study period from February to November 2004, a total of 36 eyes of 18 patients with DES requiring punctal occlusion by diathermy were recruited into the study. Nine patients were randomised to group A and nine patients were randomised into group B. Table 1 summarises the demographic data of these patients. Group A consisted of nine females. Group B consisted of seven females and two males.

There was no statistically significant difference between the mean age ($p=0.117$), mean pain score for pressure topical anaesthesia application ($p=0.612$), mean pain score for injection anaesthesia application ($p=0.454$), mean pain score for diathermy in the pressure anaesthetised eyes ($p=0.113$), and mean pain score for diathermy in the injection anaesthetised eyes ($p=0.289$) between the two groups. Table 2 summarises the means and standard deviation (SD) for the variables mentioned.

Paired t test was used to compare the pain score for pressure topical anaesthesia application with the pain score

Table 1 Summary of patient demographics

	No	Mean score/No	SD	p Value
Age				
Group A	9	45.3	13.5	0.117
Group B	9	55.6	12.6	
Sex				
Group A	9	0 male, 9 female		
Group B	9	2 male, 7 female		

Group A: RE, pressure topical anaesthesia; LE, injection anaesthesia.
 Group B: RE, injection anaesthesia; LE, pressure topical anaesthesia.

for injection anaesthesia application (table 3). Eighteen eyes of 18 patients were compared with the fellow eye of the same 18 patients. The mean pain score for injection anaesthesia was greater than for pressure topical anaesthesia application ($p < 0.0001$) (statistical power = 0.87). The mean pain score for pressure topical anaesthesia was 16.8 (SD 24.8) and for injection anaesthesia was 56.7 (SD 30.0).

There was no statistically significant difference in the mean pain score for diathermy for eyes that received pressure topical anaesthesia compared with eyes that received injection anaesthesia ($p = 0.760$) (statistical power = 0.96). The mean pain score for diathermy in the pressure anaesthetised eyes was 20.5 (SD 27.5) and in the injection anaesthetised eye was 23.1 (SD 26.3). All 18 patients preferred pressure topical anaesthesia to injection anaesthesia. None of the patients requested top-up anaesthesia and none of the patients had the procedure aborted because of intolerable pain.

DISCUSSION

Since treatment was given in one setting and outcome measures were evaluated immediately, we did not have any problems with compliance or losses to follow up which might violate randomisation and reduce comparability between treatment groups.

The majority of the patients entered into the study were females. All patients with dry eye syndrome requiring punctal occlusion seen consecutively were invited to participate in the study. None of the patients declined the invitation. The higher proportion of females recruited simply reflected the preponderance of female patients presenting with dry eye syndrome in our clinical setting.

The reason why we randomised the patients into groups A and B was to ensure that the pain scores we obtained were not affected by which procedure was performed first. For example, having injection anaesthesia first may make pressure topical anaesthesia in the fellow eye less or more painful. Alternatively, having pressure topical anaesthesia first may make injection anaesthesia in the fellow eye more or less painful.

The two groups were comparable in mean pain scores for pressure topical anaesthesia, injection anaesthesia, pain during diathermy using injection anaesthesia, and pain during diathermy using pressure topical anaesthesia. This would suggest that having either injection or pressure topical anaesthesia first did not significantly affect the results in the fellow eye or, at least, the effects have been cancelled out.

Comparing the two eyes of the same patient is the best internal control for comparing the effects of two types of treatment. Any potential unknown confounding variables

Table 2 Summary of visual analogue scores

Pain score	No	Mean score	SD	p Value
Pressure topical anaesthesia application				
Group A	9	19.9	32.3	0.612
Group B	9	13.7	15.5	
Injection anaesthesia application				
Group A	9	51.2	31.0	0.454
Group B	9	62.2	29.8	
Diathermy in the pressure anaesthetised eyes				
Group A	9	10.1	21.3	0.113
Group B	9	30.1	30.2	
Diathermy in the injection anaesthetised eyes				
Group A	9	29.9	30.7	0.289
Group B	9	16.3	20.4	

Group A: RE, pressure topical anaesthesia; LE, injection anaesthesia.
 Group B: RE, injection anaesthesia; LE, pressure topical anaesthesia.

Table 3 Paired *t* test in comparing the pain score for pressure topical anaesthesia application with the pain score for injection anaesthesia application

Pain score	No	Mean score	SD	p Value
Pair 1				
Pressure topical anaesthesia application	18	16.8	24.8	<0.0001
Injection anaesthesia application	18	56.7	30.0	
Pair 2				
Diathermy in the pressure anaesthetised eyes	18	20.5	27.5	0.760
Diathermy in the injection anaesthetised eyes	18	23.1	26.3	

would be minimised. This would also alleviate any concern one would have for potential bias with two males in one group and none in the other.

One surgeon performed all the punctal occlusion. The same power setting with the same number of applications was performed in each patient with the same diathermy machine. The same independent interviewers assessed the outcome measures. This minimised any potential bias caused by confounding by such variables.

CONCLUSION

Pressure topical anaesthesia has many advantages over conventional injection anaesthesia. We have demonstrated in this study that it is the method preferred by the majority of patients given the choice. Pressure topical anaesthesia removes the risks associated with injection anaesthesia, such as globe perforation and damage to ocular adnexae. Fears of injection are also alleviated. There is no lid swelling or periorbital haematoma, which is commonly associated with injection anaesthesia and can persist for several days.

ACKNOWLEDGEMENTS

We thank all the staff and colleague at United Christian Hospital who helped with the study.

Authors' affiliations

R W K Law, D S C Lam, Department of Ophthalmology and Visual Sciences, The Chinese University of Hong Kong, Hong Kong Eye Hospital, Kowloon, Hong Kong, People's Republic of China
R T H Li, J S M Lai, Department of Ophthalmology, United Christian Hospital, Kowloon, Hong Kong, People's Republic of China

Financial support: none

Competing interests: none declared

Proprietary interest: none

Ethical approval: Previous approval of the study protocol by the ethics committees of the United Christian Hospital was obtained.

Correspondence to: Dr Randa T H Li, Department of Ophthalmology, United Christian Hospital, Hip Wo Street, Kwun Tong, Kowloon, Hong Kong; drrandali@yahoo.com.hk

Accepted for publication 1 May 2005

REFERENCES

- 1 **Lemp MA**. Report of the National Eye Institute/Industry workshop on clinical trials in dry eyes. *CLAO J* 1995;**21**:221–32.
- 2 **Stern ME**, Beuerman RW, Fox RI, *et al*. The pathology of dry eye: the interaction between the ocular surface and lacrimal glands. *Cornea* 1998;**17**:584–9.
- 3 **Bell RW**, Butt ZA, Gardner RF. Warming lignocaine reduces the pain of injection during local anaesthetic eyelid surgery. *Eye* 1996;**10**(Pt 5):558–60.
- 4 **Morris R**, McKay W, Mushlin P. Comparison of pain associated with intradermal and subcutaneous infiltration with various local anesthetic solutions. *Anesth Analg* 1987;**66**:1180–2.
- 5 **Morris RW**, Whish DK. A controlled trial of pain on skin infiltration with local anaesthetics. *Anaesth Intensive Care* 1984;**12**:113–14.
- 6 **Li RT**, Lai JS, Ng JS, *et al*. Efficacy of lignocaine 2% gel in chalazion surgery. *Br J Ophthalmol* 2003;**87**:157–9.
- 7 **Jones LT**. The lacrimal secretory system and its treatment. *J All India Ophthalmol Soc* 1966;**14**:191–6.
- 8 **Scott J**, Huskisson EC. Graphic representation of pain. *Pain* 1976;**2**:175–84.
- 9 **Ohnhaus EE**, Adler R. Methodological problems in the measurement of pain: a comparison between the verbal rating scale and the visual analogue scale. *Pain* 1975;**1**:379–84.
- 10 **Sriwatanakul K**, Kelvie W, Lasagna L, *et al*. Studies with different types of visual analog scales for measurement of pain. *Clin Pharmacol Ther* 1983;**34**:234–9.