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Original Article

Comparison of trichiasis recurrence after primary bilamellar tarsal rotation or anterior lamellar repositioning surgery performed for trachoma

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Abstract

Background: To compare the trichiasis recurrence rate following bilamellar tarsal rotation or anterior lamellar repositioning, performed as primary surgery for trachomatous trichiasis.

Design: Retrospective consecutive case series.

Participants: All cases of trachomatous trichiasis undergoing primary surgical correction at Alice Springs Hospital, Alice Springs, Northern Territory, Australia, between 1 June 2001 and 11 June 2011 were included.

Methods: Retrospective chart review. Key baseline, operative and outcome details were collected from the notes.

Main Outcome Measure: Recurrent trichiasis was defined as one or more lashes touching the cornea, resulting in recurrent symptoms of trichiasis and warranting further surgery in the opinion of the treating ophthalmologist.

Results: Sixty-seven BTR and eighteen ALR procedures were performed, with BTR being performed from 2001 to 2008, and ALR from 2008 to 2011. The mean follow-up times were significantly different for the BTR group (1654 days) and for the ALR group (673 days) ($P < 0.001$). Kaplan–Meier survival analysis did not reveal any significant differences in recurrence rate between the two procedures overall ($P = 0.935$). Analysis of the 2008 calendar year (the only year where both procedures were performed and therefore had equal follow-up times) suggested that ALR might have a lower recurrence rate (1/10 ALR recurrences *vs.* 4/6 BTR recurrences, $P = 0.181$).

Conclusions: The results do not demonstrate a difference in the recurrence rate between the two techniques. Inconsistent follow times however leave uncertainty in this result, and a larger prospective randomised study is warranted to address this question.

Key words: anterior lamellar repositioning, bilamellar tarsal rotation, cictricial entropion, trachoma, trichiasis.

Introduction

Trachoma is responsible for approximately 3% of blindness worldwide.[1] There are some 40.6 million people suffering from active trachoma and 8.2 million people suffering from trachomatous trichiasis (TT).[2]

Trachoma is initiated by chronic *Chlamydia trachomatis* conjunctivitis.[3] Risk factors for infection

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include poor facial hygiene and poor living conditions. Conjunctivitis encompasses the first two of five steps in the World Health Organization's (WHO) simplified assessment of trachoma criteria: trachomatous inflammation, follicular (TF); trachomatous inflammation, intense (TI); trachomatous scarring (TS); trachomatous trichiasis (TT); and corneal opacity (CO).[4] Repeated infection is critical to the disease process, causing tissue damage and fibrosis that leads to contraction band formation and the rolling inward of the superior tarsus and palpebral margin (entropion).[5] When severe enough, entropion results in trichiasis (TT), causing eyelashes to rub on the conjunctiva and/or cornea of the eye. Untreated, the rubbing from eye movement is a constant irritant and causes scarring and opacification of the cornea, resulting in blindness (CO).[6,7] With early intervention this condition is fully treatable with surgery – TT is an entirely preventable cause of blindness.[3]

In Australia's general population, the prevalence of trachoma is negligible, as with all other developed countries. However, amongst the Indigenous population of Australia, trachomatous inflammation (TF, TI) and scarring (TS) remains hyper-endemic in some areas. Australia is the only developed country to have trachoma as a public health issue.[8] Although decreasing, the prevalence is still above the threshold set by the WHO to represent a serious public health problem.[3,9–12] The rates of trichiasis (TT) and corneal opacity in adults in some Indigenous communities have been shown to be between 6% and 14%, and between 2% and 3%, respectively.[10,13]

In 1996, the WHO developed the 'SAFE' strategy to tackle trachoma, comprising surgery, antibiotics, facial cleanliness, and environmental health improvements.[14] This study reviews the surgery used to halt progression of trichiasis to corneal opacity, which may also permit improved visual acuity.[15,16] Currently, the WHO recommends the bilamellar tarsal rotation (BTR) procedure to correct all severities of entropion-induced trichiasis.[14,17] This same BTR procedure was used at the Alice Springs Hospital (ASH) in the Northern Territory up until and including 2008. Beginning 2008 also, following personal communication with J.R.O. Collin at a National Conference in Australia regarding the proneness of BTR to recurrence, the anterior lamellar repositioning (ALR) technique was introduced, as it was suggested as a potentially effective long-term alternative. ALR has been used exclusively since 2009 also for all severities of trichiasis.[18,19]

The aim of this study was to compare the success rate of BTR with ALR in the primary management of trachomatous trichiasis.

Methods

Participants

Patients undergoing primary surgery for upper lid TT at the ASH between 1 June 2001 and 11 June 2011 were eligible for inclusion. Cases were identified through a search of the electronic records kept both at ASH, and also through a search of an electronic database maintained by one of the authors (TH). The ophthalmologist specialist present made the diagnoses. Patients who had primary surgery using a lid architecture-altering technique other than BTR or ALR were not included. Techniques involving only lashes such as epilation were also not included in the present study. Patients with follow-up times of less than 6 months were excluded, and patients noted with recurrence within 6 months were documented but not included in the main analysis. This was done to reduce the chance of primary surgical failure confounding comparison of long-term recurrence rates between the two techniques and leading to bias towards early recurrence. All patients were of Aboriginal or Torres Strait Islander descent.

Methods

Both paper and computer database medical records were searched for evidence of operations performed to correct upper lid TT. Where possible, paper records were cross-matched with computer records for waiting list admission dates, procedure details (consent forms, anaesthetic records and surgical records), and day-one post-operative follow-up notes. Only operations with completed procedure details in the form of paper notes were included in the study. De-identified personal information concerning date of birth, date of death (if applicable), gender, current location of postal address, history of prior trachoma surgery, date of waiting list admission, date of surgery, lid operated on, knowledge of subsequent recurrence of trichiasis, date of subsequent waiting list admission, date of subsequent surgery and date of last ophthalmic review were collected into a Microsoft Excel spreadsheet.

A patient's current postal address was used as the most accurate indicator of current place of residence. For those with recurrence, the time to recurrence (their follow-up time) was calculated as the time from the date of surgery to the first known date of recurrence or in lieu the date of revision surgery. For those with no recurrence, the follow-up time was calculated as the time between the date of surgery and the date of last ophthalmic review.

The study was granted ethics approval by the Central Australian Human Research Ethics Committee (CAHREC) (APP# 2011.10.01) and also the

Australian National University Human Ethics Committee (APP# 2011/559).

Procedures

All procedures were performed by TH, visiting specialists, or training specialists. TH directly supervised the majority of cases not performed by himself to minimize the known effect of surgeon on recurrence.

Anterior lamellar repositioning:[20]

The technique used is similar to that described by Ross *et al.* but without specific levator recession or buccal mucosal grafts. Following local anaesthetic infiltration, the mucocutaneous junction of the eyelid margin is incised at the grey line to separate the anterior and posterior lamella. The initial incision is superficial (<2 mm), to prevent losing the tissue plane and inadvertently cutting through the tarsal plate. A low skin crease incision is made at 4 mm from the upper eyelid margin and the tarsal plate is exposed. Blunt dissection is carried out over the tarsus to join the grey line incision. The operation may be commenced from the grey line incision or from the skin crease incision, but they are dissected to meet and separate the anterior and posterior lamellar along the length of the eyelid. Double-armed 5/0 vicryl sutures are placed partial thickness through the tarsal plate and emerge through the anterior lamella close to the upper eyelid margin. The bare eyelid margin is allowed to epithelialize.

Bilamellar tarsal rotation:[21]

A full thickness lid incision is made through the anterior and posterior lamellae followed by three or occasionally four, 5/0 double-ended absorbable everting sutures, which are placed in the lower end of the proximal posterior lamellar (tarsal plate). They pass forward and distally to emerge just above the lash line in the anterior lamellar. When tightened, they evert the lower section of the lid by rotating the terminal tarsus and overlying anterior lamellar including the lashes (thus bilamellar).

Statistical analysis

All analyses were performed using IBM SPSS software version 21.0 (Armonk, NY, USA). Associations between the categorical variables of procedure, recurrence, gender, lid and place of residence were evaluated using the Pearson chi-squared test where appropriate. The continuous variables age, time to recurrence and follow-up times were evaluated using two-sided *t*-tests. Kaplan–Meier plots were constructed and used to illustrate time to recurrence for each technique. Differences in recurrence were also assessed using the log rank test. *P*-values less than 0.05 were considered to be statistically significant.

Results

Of the 150 procedures for TT during the study period, 39 were excluded as they were not primary operations to correct trichiasis (see Fig. 1). Of the 111 primary operations, 1 was excluded because follow-up time was not calculable, and 20 were excluded because follow-up times were less than 183 days and no recurrence was noted. Five procedures (four BTR and one ALR) with recurrence inside 183 days were not included in the analysis. Overall, 85 procedures were performed on 63 patients, with 48 BTR patients (18 bilateral, 29 unilateral and 1 mixed) and 16 ALR patients (2 bilateral, 13 unilateral, and 1 mixed). The one mixed case had a BTR procedure done on one eye and an ALR procedure done on the other eye and

Figure 1. Flow diagram of patients and procedures.

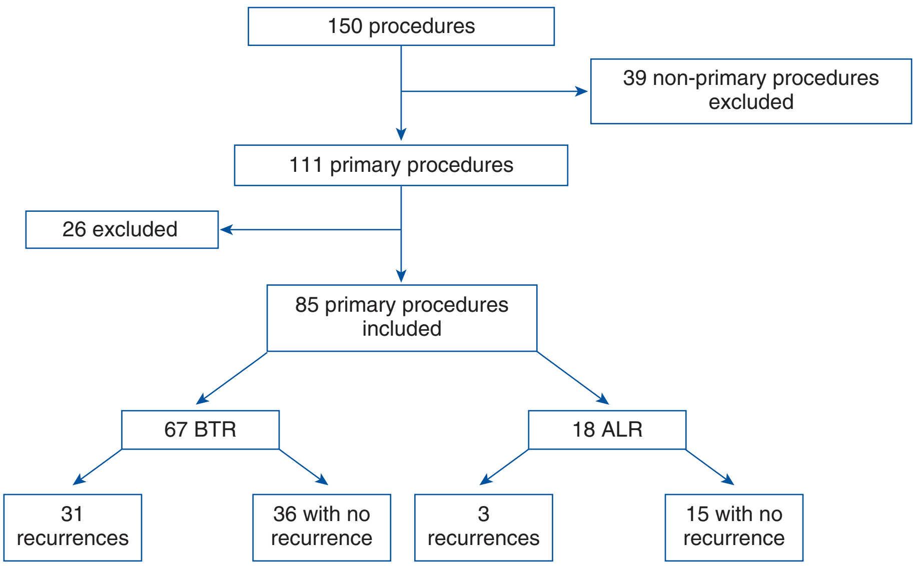

Table 1. Baseline features of BTR and ALR patients from 2001–2011

Patient features	BTR	ALR	*P*-value
Total lids *n* (%)	67/85 (79)	18/85 (21)	–
Total patients *n* (%)	48/63§ (76)	16/63§ (24)	–
Gender: Female *n* (%)	56/67 (84)	13/18 (72)	$P = 0.313$†
Lid: Left *n* (%)	34/67 (51)	9/18 (50)	$P = 0.955$†
Residence: Alice Springs *n* (%)	21/67 (31)	3/18 (17)	$P = 0.256$†
Average age in years (min, max) $n = 85$	60.2 (30,86)	62.6 (47,75)	$P = 0.435$‡

†Chi-squared test. ‡*t*-test. §One patient received one BTR and one ALR procedure. ALR, anterior lamellar repositioning; BTR, bilamellar tarsal rotation.

Table 2. Surgical details of BTR and ALR patients from 2001–2011

Surgical details	BTR	ALR	*P*-value
Recurrence *n* (%)	31/67 (46)	3/18 (17)	–
Mean follow-up time in days (min, max) $n = 85$	1654 (190, 3734)	673 (196, 1414)	$P < 0.001$†
Mean time to recurrence in days (min, max) $n = 34$	1078 (204, 2927)	681 (588, 768)	$P = 0.290$†

†*t*-test.

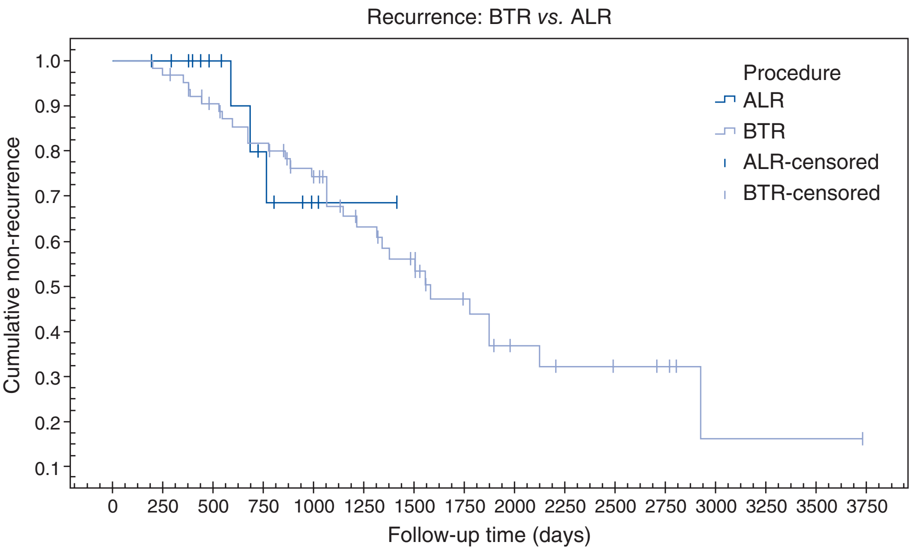

Figure 2. Overall Kaplan–Meier survival plot of 85 procedures, where survival is the lack of recurrence with regard to time of follow-up.

therefore counted as a patient for both procedures. There were five procedures (three BTR and two ALR), all with no recurrence, that had follow-up times in the period of 183–365 days.

Table 1 presents baseline data comparing the BTR and ALR groups, and Table 2 contains the outcome data. The follow-up time was significantly longer for the BTR group ($P < 0.001$), making any difference in recurrence rate impossible to interpret. As a result, Kaplan–Meier survival analysis of non-recurrence for the 'overall' group of 67 BTR and 18 ALR procedures was conducted and is presented in Figure 2. This fails to demonstrate a clear trend favouring either procedure (31/67 BTR and 3/18 ALR recurrences, $P = 0.935$, log rank test). In addition, analysis of a separate 'subgroup' of 6 BTR and 10 ALR procedures from 2008 did not show a significant difference (4/6 BTR and 1/10 ALR recurrences, $P = 0.181$, log rank test); however, the numbers in this group were very small. This particular subgroup was chosen prior to examining the outcome data in an effort to standardize follow-up time (this was the only overlapping year both procedures were being performed). Follow-up time was similar (965 *vs.* 733 days, $P = 0.204$). There were no significant differences between demographic characteristics for these subgroups (data not shown).

Discussion

Kaplan–Meier log rank analysis in this retrospective chart review failed to demonstrate a difference in recurrence between BTR and ALR procedures. Though cross-tabulation analysis yielded a significant result (not shown), this is not valid as the BTR group was followed-up for a significantly longer time period. When taking this into account and controlling for follow-up time, Kaplan–Meier log rank analysis of the 2008 subgroup also failed to reach statistical significance. However, the number of cases in this group was very small ($n = 16$), and the results (1/10 ALR recurrences *vs.* 4/6 BTR recurrences, $P = 0.181$) do lean towards a difference in the two techniques.

Previous studies have shown the WHO endorsed BTR technique to have recurrence rates of between 18.4% and 55%.[21–25] In comparison to these studies, our results indicate a BTR recurrence of 49%. Previous studies have shown variants of ALR to have recurrence rates of between 2.9% and 29%.[18,20,26–29] Our results suggest a relatively high recurrence rate of 21% after ALR. In that respect, it is possible that not doing levator recession, assuming that retraction was an insignificant component, could be a reason for the failure of some of these cases.

Recurrences within 6 months may be considered to be likely to represent primary surgical failure, and so were left out of the main analysis to reduce the potential to bias the data towards early failures.[30] Our definition of recurrence at any point in the follow-up time is similar to Merbs *et al*.[22] Our results indicate that the time to recurrence can be anywhere from 204 days to 2927 days (8 years), with means of 1078 days (3 years) and 681 days (1.9 years) for BTR and ALR procedures ($n = 34$, $P = 0.290$). Many studies have had limited follow-up, and the relatively high recurrence rates for both techniques in this study may be due to the longer follow-up.[18,22,26,27,30,31] Our results suggest that any future studies of the surgical management of TT should have a follow-up of at least 24 months in order to highlight long-term free outcomes.

In contrast to the findings of Kerie and Bejiga,[32] who commented on a trend in operation outcomes between left and right eyelids for BTR ($P > 0.05$), we did not find any analogous trends for either technique ($P = 0.955$ overall, $P > 0.999$ in 2008). Here they commented on the technique of the surgeon, which is another important limitation of this study, as too is the 'learning curve' of the surgeon. Although the majority of operations were performed by TH, we have not examined inter-surgeon variability, suggested important by Emerson *et al*. and Rajak *et al*. as the numbers were too small and the relevant data were not collected.[30,33]

We observed that the majority of patients were women. This has previously been suggested by Congdon *et al*. to be due to the role of women having more contact with children, and consequently being more vulnerable to facial cleanliness and environmental factors such as fly exposure, leading to chronic trachoma.[34] It could also reflect the ratio of genders in Indigenous communities, especially because the mean age of surgery approaches the age of life expectancy, and there is a difference between the expectancies of men and women.[35] Having women access healthcare more would also explain such a result.

Despite the possibility of gender differences in access to healthcare, it is interesting to note that more than half of patients were from remote communities outside of the Alice Springs area (69% and 83% for BTR and ALR, respectively). These statistics highlight the limitation on the services offered by ASH, with the implications for each patient's post-surgical prognosis, compounded by factors such as severity of disease, wound healing ability, immunogenetic factors, older age, and *C. trachomatis* and other bacterial infections.[15,30]

All in all, the rate of recurrence is still high, and although this study concentrated on the surgical aspects of the SAFE strategy, it is important to remember the reasons for recurrence in the context of the individual.[36] Antibiotics, facial cleanliness and environmental infrastructure such as clean water and latrine provisions all help prevent the cycle and spread of ocular infection, and are therefore critically important, in addition to surgery, to prevent surgical failure.

We conclude that we could not establish a significant difference in trichiasis recurrence between the ALR technique and the World Health Organization-endorsed BTR technique in this setting. Inconsistent follow times, however, leave uncertainty in this result.

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References

1. Pascolini D, Marlotti SP. Global estimates of visual impairment: 2010. *Br J Ophthalmol* 2012; **96**: 614–18.
2. Mariotti SP, Pascolini D, Rose-Nussbaumer J. Trachoma: global magnitude of a preventable cause of blindness. *Br J Ophthalmol* 2009; **93**: 563–8.
3. Royal Australian College of Ophthalmologists. *National Trachoma and Eye Health Program*. Sydney: Royal Australian College of Ophthalmologists, 1980.

4. Thylefors B, Dawson CR, Jones BR, West SK, Taylor HR. A simple system for the assessment of trachoma and its complications. *Bull World Health Organ* 1987; **65**: 477–83.
5. Taylor HR, Prendergast RA, Dawson CR, Schachter J, Silverstein AM. An animal model for cicatrizing trachoma. *Invest Ophthalmol Vis Sci* 1981; **21**: 422–33.
6. Taylor H, Keeffe J, Arnold AL *et al*. *National Indigenous Eye Health Survey*. Melbourne: Indigenous Eye Health Unit, Melbourne School of Population Health, University of Melbourne, 2009.
7. Taylor HR, Keeffe JE, Vu HT *et al*. Vision loss in Australia. *Med J Aust* 2005; **182**: 565–8.
8. Taylor HR. Trachoma in Australia. *Med J Aust* 2001; **175**: 371–2.
9. Ewald DP, Hall GV, Franks CC. An evaluation of a SAFE-style trachoma control program in Central Australia. *Med J Aust* 2003; **178**: 65–8.
10. Taylor HR, Fox SS, Xie J, Dunn RA, Arnold AL, Keeffe JE. The prevalence of trachoma in Australia: the National Indigenous Eye Health Survey. *Med J Aust* 2010; **192**: 248–53.
11. Taylor HR, English DR, Field BA, Spicer PE, Graham DM. Prevalence of trachoma in a single community, 1975–2007. *Clin Experiment Ophthalmol* 2012; **40**: 121–6.
12. Adams KS, Burgess JA, Dharmage SC, Taylor H. Trachoma surveillance in Australia, 2009. A report by the National Trachoma Surveillance and Reporting Unit. *Commun Dis Intell* 2010; **34**: 375–95.
13. Landers J, Kleinschmidt A, Wu J, Burt B, Ewald D, Henderson T. Prevalence of cicatricial trachoma in an indigenous population of Central Australia: the Central Australian Trachomatous Trichiasis Study (CATTS). *Clin Experiment Ophthalmol* 2005; **33**: 142–6.
14. World Health Organization. *Program for the Prevention of Blindness and Deafness. Future Approaches to Trachoma Control. Report of a Global Scientific Meeting, Geneva 1996*. Geneva: WHO, 1997.
15. Burton MJ, Bowman RJ, Faal H *et al*. Long term outcome of trichiasis surgery in the Gambia. *Br J Ophthalmol* 2005; **89**: 575–9.
16. Woreta TA, Munoz BE, Gower EW, Alemayehu W, West SK. Effect of trichiasis surgery on visual acuity outcomes in Ethiopia. *Arch Ophthalmol* 2009; **127**: 1505–10.
17. Reacher MH, Huber MJ, Canagaratnam R, Alghassany A. A trial of surgery for trichiasis of the upper lid from trachoma. *Br J Ophthalmol* 1990; **74**: 109–13.
18. Rhatigan MC, Ashworth JL, Goodall K, Leatherbarrow B. Correction of blepharoconjunctivitis-related upper eyelid entropion using the anterior lamellar reposition technique. *Eye (Lond)* 1997; **11** (Pt 1): 118–20.
19. Sodhi PK, Yadava U, Pandey RM, Mehta DK. Modified grey line split with anterior lamellar repositioning for treatment of cicatricial lid entropion. *Ophthalmic Surg Lasers* 2002; **33**: 169–74.
20. Ross AH, Cannon PS, Selva D, Malhotra R. Management of upper eyelid cicatricial entropion. *Clin Experiment Ophthalmol* 2011; **39**: 526–36.
21. Reacher M, Foster A, Huber J. *Trichiasis Surgery for Trachoma: The Bilamellar Tarsal Rotation Procedure*. WHO /PBL/93.29. Geneva: World Health Organization, 1993.
22. Merbs SL, West SK, West ES. Pattern of recurrence of trachomatous trichiasis after surgery: surgical technique as an explanation. *Ophthalmology* 2005; **112**: 705–9.
23. Bowman RJ, Jatta B, Faal H, Bailey R, Foster A, Johnson GJ. Long-term follow-up of lid surgery for trichiasis in the Gambia: surgical success and patient perceptions. *Eye (Lond)* 2000; **14** (Pt 6): 864–8.
24. Reacher MH, Munoz B, Alghassany A, Daar AS, Elbualy M, Taylor HR. A controlled trial of surgery for trachomatous trichiasis of the upper lid. *Arch Ophthalmol* 1992; **110**: 667–74.
25. Khandekar R, Al-Hadrami K, Sarvanan N, Al Harby S, Mohammed AJ. Recurrence of trachomatous trichiasis 17 years after bilamellar tarsal rotation procedure. *Am J Ophthalmol* 2006; **141**: 1087–91.
26. Kemp EG, Collin JR. Surgical management of upper lid entropion. *Br J Ophthalmol* 1986; **70**: 575–9.
27. Dhaliwal U, Monga PK, Gupta VP. Comparison of three surgical procedures of differing complexity in the correction of trachomatous upper lid entropion: a prospective study. *Orbit* 2004; **23**: 227–36.
28. Hintschich CR. Anterior lamellar repositioning' for correction of entropion of the upper eyelid. *Ophthalmologe* 1997; **94**: 436–40.
29. Rajak SN, Collin JRO, Burton MJ. Trachomatous trichiasis and its management in endemic countries. *Surv Ophthalmol* 2012; **57**: 105–35.
30. Rajak SN, Makalo P, Sillah A *et al*. Trichiasis surgery in the Gambia: a 4-year prospective study. *Invest Ophthalmol Vis Sci* 2010; **51**: 4996–5001.
31. El Toukhy E, Lewallen S, Courtright P. Routine bilamellar tarsal rotation surgery for trachomatous trichiasis: short-term outcome and factors associated with surgical failure. *Ophthal Plast Reconstr Surg* 2006; **22**: 109–12.
32. Kerie A, Bejiga A. Pattern of recurrence of trachomatous trichiasis after surgery in Enemor and Ener district, Central Ethiopia. *Ethiop Med J* 2010; **48**: 301–8.
33. Emerson PM, Burton M, Solomon AW, Bailey R, Mabey D. The SAFE strategy for trachoma control: using operational research for policy, planning and implementation. *Bull World Health Organ* 2006; **84**: 613–19.
34. Emerson PM, Cairncross S, Bailey RL, Mabey DC. Review of the evidence base for the 'F' and 'E' components of the SAFE strategy for trachoma control. *Trop Med Int Health* 2000; **5**: 515–27.
35. Australian Institute of Health and Welfare. *The Health and Welfare of Australia's Aboriginal and Torres Strait Islander People, An Overview 2011*. Canberra: Australian Institute of Health and Welfare, 2011.
36. Yorston D, Mabey D, Hatt S, Burton M. Interventions for trachoma trichiasis. *Cochrane Database Syst Rev* 2006; (3): CD004008.