Use of soft contact lenses in an eye casualty department for the primary treatment of traumatic corneal abrasions

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SUMMARY We have assessed the role of bandage contact lenses in the primary treatment of traumatic corneal abrasions. Patients treated with bandage lenses healed more quickly ($0.05 > p > 0.02$) and with less discomfort ($0.05 > p > 0.02$) than those treated traditionally, with the added advantage of maintaining vision during treatment. Resterilisation of contact lenses reduces the cost and makes the treatment economically viable. Large diameter lenses were fitted satisfactorily without the use of keratometry.

Traumatic corneal abrasions represent a substantial proportion of the problems presenting to the eye casualty department. In a recent three-month period at St Thomas's Hospital 120 (11%) out of 1086 new patients were treated for this common problem. Chiapella and Rosenthal¹ have recently reported a similar frequency of 848 (12.9%) out of 6576 patients seen in a year at Leicester Royal Infirmary. Each patient with this injury suffers marked short term discomfort and visual disability.

Traditionally the management of corneal abrasions consists of topical mydriatics, antibiotics, and pad and bandage. The healing period may last for several days and is associated with continuing pain and further visual disability from the dressing. Alternatively, ocular surface abnormalities can be successfully treated with bandage contact lenses, achieving the goals of pain reduction, facilitation epithelial healing, and proper surface hydration.² Moreover, visual function is retained. The secondary use of such lenses has been reported in cases of delayed healing of corneal abrasions or where damage to the basement membrane and Bowman's layer is associated with epithelial instability and recurrent erosions.² There have been no reported trials of the use of bandage lenses in the primary management of corneal abrasions, and this study sets out to show that patients with large surface area losses ($>4 \text{ mm}^2$) may benefit from this approach.

Material and methods

All patients seen in the eye casualty department at St Thomas's Hospital between 7 February and 20 July 1985 were considered. Twenty eight patients with traumatic abrasions were entered in a randomised controlled trial after fulfilling the following criteria: the abrasion was of a surface area of greater than 4 mm^2 , the patient was over 18 years and under 65 years old, there was no evidence of secondary infection or retained foreign body or coincidental ocular pathology, and no previous treatment had been given. The area of abrasion was measured by the slit-lamp gated beam. No assessment of basement membrane damage was made.

Suitable patients were randomly allocated into one of two treatment groups: (a) occlusive pad and bandage, (b) bandage contact lens. All patients received guttae chloramphenicol 0.5% and homatropine 2%. Focus 80 0.16 mm centre thickness, 8.6 mm back central optic radius, 14.5 mm diameter, 80% water plano hydrophilic contact lenses were

Fig. 1 Patients were shown this figure and they marked the percentage of their pretreatment pain that they experienced after one day.

Table 1 Patients treated with pad and bandage

Number	Hours since injury	Age	Surface area of abrasion (mm ²)	Pain score on day 1 (%)	Days until healing	Mode of injury	Comments
1	3	33	8	95	4	Grit in eye	
3	5	32	4	100	2	Poked finger in eye	
9	2	25	12	100	4	Baby poked finger in eye	Defaulted after three days
10	47	29	20	150	3	Sheet of paper in eye	Redundant corneal epithelium debrided at presentation. Returned after six days with minor recurrent abrasion
11	14	29	8	120	4	Baby poked finger in eye	Defaulted after three days
13	2	30	9	10	3	Floppy disc in eye	
16	6	47	4	25	3	Awoke with painful eye	
18	22	49	16	40	2	Baby poked finger in eye	Redundant corneal epithelium debrided
19	72	28	7	25	3	Baby poked finger in eye	
20	2	25	4	20	1	Cigarette in eye	
23	20	35	6	75	2	Foreign body in eye while hammering	Defaulted after one day
26	2	43	6	20	1	Baby poked finger in eye	
27	2	33	30	195	2	Awoke with painful eye	Redundant corneal epithelium debrided
28	50	28	18	25	2	Finger nail in eye	
Mean	17.79	33.28	10.86	71.43	2.57		
Standard deviation	21.77	7.43	7.33	55.11	0.98		
Standard error of mean	5.82	1.99	1.96	14.74	0.26		

used. They were applied without preliminary keratometry. The patients were reviewed daily and the abrasions considered healed when local punctate keratitis only could be observed on slit-lamp biomicroscopy of the injured site. Each day the patients made an assessment of their pain on a visual analogue scale (Fig. 1).

Results

These are summarised on Tables 1, 2, and 3, and in Figs. 2 and 3. The groups were compared by a two-tailed Student's *t* test. The patients in each treatment group were comparable with respect to age, time elapsed since injury, and size of abrasion ($0.05 > p > 0.1$). Those treated with a bandage lens noted less pain after 24 hours than those treated with a pad and bandage ($0.05 > p > 0.02$). They also reached the healing point more quickly ($0.05 > p > 0.02$). In the contact lens group patient no.6 could not tolerate a lens for more than 24 hours, by which time the abrasion had virtually healed, and had to be changed to a pad and bandage. Patient no.8 went for six days without reattending and has been excluded from the analysis.

In the pad and bandage treatment group patients 9, 11, and 23 all failed to attend for final review and discharge after daily attendances while the abrasions remained unhealed. It is assumed that these lesions had healed by the following day, but they might in

fact have taken rather longer. In that case the difference between the average healing times of the two groups would have been more marked.

Discussion

After corneal epithelial injury there is a cellular response within 1–5 hours leading to infiltration by polymorphonuclear leucocytes and macrophages. The adjacent epithelium undergoes amoeboid transformation and cell division, and the defect may be covered within 24–48 hours. Epithelial stability requires the presence of an intact basement membrane, proper surface hydration, an absence of secondary infection, normal precorneal tear film function, and protection from further lid induced trauma during blinking.^{2,3} Soft bandage contact lenses may offer these conditions more reliably than an occlusive dressing, just as they have already been shown to be helpful in the management of many corneal surface diseases and certain penetrating injuries.²⁻⁵ However, Williams and Buckley have recently shown bandage lenses to be singularly unhelpful and possibly detrimental when compared with the topical application of oculentum simplex in the management of recurrent corneal erosions in map-dot-fingerprint dystrophy,⁶ but they also suggest that trauma is of little importance in the production of erosions in this condition.

The study suggests that the primary treatment of

Use of soft contact lenses

Table 2 Patients treated with bandage contact lens

Number	Hours since injury	Age	Surface area of abrasion (mm ²)	Pain score on day 1 (%)	Days until healing	Mode of injury	Comments
2	0.75	27	8	25	2	Radio aerial in eye	
4	2	51	20	10	1	Punched in eye	
5	14	32	12	15	2	Fell off motorcycle	
6	11	28	34	75	3	Taking off makeup	Unable to tolerate bandage contact lens in spite of cornea virtually healing in one day; changed to chloramphenicol eye ointment and pad
7	14	25	5	70	2	Foreign body hitting eye	
8	29	67	6	?	?	Foreign body hitting eye	Failed to attend until telephoned and requested to return to casualty department
12	4	22	4	40	2	Plant leaf in eye	
14	4.5	76	48	30	2	Tear ducts syringed earlier in the day	Returned the next day with a recurrent abrasion
15	12	26	8	20	2	Punched in eye	Redundant corneal epithelium debrided before lens applied
17	29	36	4	10	1	Unknown	
21	4	44	28	10	2	Foreign body hitting eye	
22	23	33	9	50	2	Scratched in eye by dog's claw	Returned after two weeks with a minor recurrent corneal abrasion
24	26	42	16	50	1	Plaster in eye	
25	10	27	4	30	2	Pencil poked in eye	
Mean	12.95	38.28	14.71	33.46	1.85		
Standard deviation	9.46	15.77	12.90	21.34	0.53		
Standard error of mean	2.53	4.22	3.45	5.71 (n=13)	0.14 (n=13)		

traumatic corneal abrasions with soft contact lenses has an apparent advantage over the traditional occlusion in terms of reduced pain during healing and speedier healing. To this can be added the further advantage of faster rehabilitation; four of our patients were able to return to work with their lenses in situ. Possible disadvantages are seen from the patient who defaulted from follow-up with a contact

Table 3 Statistical analysis of the results for the two treatment groups

	Patients treated with pad + bandage		Patients treated with bandage contact lens		t	p
	Mean	Standard deviation	Mean	Standard deviation		
Hours since injury	17.79	21.77	12.95	9.46	0.76	Not significant
Age	33.28	7.43	38.28	15.77	1.07	0.5 > p > 0.1
Surface area of abrasion	10.86	7.33	14.71	12.90	0.97	0.5 > p > 0.1
Pain score after 24 h of treatment	71.43	55.11	33.46	21.34	2.39	0.05 > p > 0.02
Days until healing	2.57	0.98	1.85	0.53	2.40	0.05 > p > 0.02

Fig. 2 Pain score after one day.

Fig. 3 Number of days until healing.

lens fitted (no.8). In this case there was no problem when he was seen and the lens removed six days later. However, the complications of prolonged usage are well known, and a patient who absconds with a lens in place may be at some risk.²⁷ In a series of 322 cases of ulcerative keratitis 56 (17%) were associated with the use of contact lenses, and of these 86% were soft lenses for the correction of ametropia.⁸ Soft contact lenses are an important risk factor for the development of infected corneal ulcers, but traumatic abrasions are also a risk factor, and we believe that with properly sterilised and fitted bandage lenses, and with the use of a prophylactic broad spectrum antibiotic, the risks are minimal over such a short period of time. In most patients the abrasion healed within two days, after which the lens was removed.

The study further shows that fitting a bandage lens without complication can be undertaken by ophthalmic casualty medical staff without the use of keratometry or special training, provided a large back optic radius lens is used. The availability of a keratometer and specialised contact lens experience is beyond the scope of a routine ophthalmic casualty service. We explicitly set out to show that, with a careful choice of suitable lens and a clinical check for fit at the time of application, followed by short term therapeutic use, keratometry is unnecessary. Our findings bear this out, as poor fit was not a practical problem.

A further potential problem with bandage lenses is that of corneal hypoxia. The partial pressure of oxygen in the precorneal tear film is about 155 mmHg with the eyes open and falls to 55 mmHg on eyelid closure.^{9,10} It falls further when the lids are closed and a soft lens is in place, to a level of 23 mmHg or below, and clinically significant corneal hypoxia may result.^{9,10} It has been held that even lenses with a high oxygen permeability {DK of over 40 (cm²/s)(m102/ml

× mmHg) × 10⁻¹¹ (35°C)} and low centre thickness may approach this threshold. The Focus 80 lens has a DK of 48.6 (cm²/s)(m102/ml × mmHg) × 10⁻¹¹ (35°C) and a centre thickness of 0.16 mm.¹¹ No problems of corneal oedema were observed in our patients and the risk of corneal hypoxia does not appear to be important. This is reflected in the increased healing of the abrasion in the soft lens group, possibly because these patients have greater oxygen exposure during the day, when their eyes are open, than those in the pad and bandage group, who may be relatively hypoxic all the time.

Limitations of the use of such treatment are the obvious ones of expense and availability of lenses. Each bandage lens costs £15 to the NHS compared with about £3 for three days' treatment with a pad and bandage. However, this is offset by the facts that these lenses may be resterilised either by heat or chemically,¹¹ and that fewer casualty attendances may be required of the patient and of the department's resources, so that the treatment may be more economical.

The limitations of this study are the relatively small number of patients, the four patients who failed to observe the follow-up protocol, the lack of data on the condition of the basement membrane and Bowman's layer at the time of initial assessment, and the lack of long-term follow-up to assess the problem of recurrent abrasions. Brown and Bron,¹² reviewing recurrent erosions, found a history of trauma in 56% of 80 patients, 65% of which occurred within four months of the original injury. However, no one to our knowledge has investigated prospectively the impact of primary treatment on this complication. We found that in the contact lens group two patients returned shortly after the healing point with recurrent erosions, one after only 24 hours and the other after 14 days. No such problems were noted with the pad and bandage group. We conclude that the results support the hypothesis that bandage contact lenses used in the primary treatment of traumatic corneal abrasions offer certain advantages over conventional treatment, namely a faster and more comfortable healing period at a reasonable economic cost.

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