Original article

Therapeutic application of Poly-2-hydroxy ethyl methacrylate contact lens in various ocular surface disorders among Nepalese population

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ABSTRACT

Introduction: Therapeutic contact lens (TCL) is indicated to relieve pain, promote corneal wound healing, provide mechanical protection and support, maintain corneal hydration, improve vision and seal or splint cornea in various ocular surface disorders. Till date no study has been reported about use of contact lenses for these purposes in Nepalese population. This study thus aims to evaluate the outcome of TCL in ocular surface disorders in Nepalese population.

Methods: A prospective analysis of patients fitted with TCL for various ocular surface disorders was done at B.P. Koirala Lions centre for Ophthalmic Studies. All the subjects were fitted with Poly-2-hydroxy ethyl methacrylate (70% water content); information on clinical conditions were evaluated and recorded at initial and final treatment visit.

Results: Of 57 eyes fitted with TCL, corneal laceration caused by mechanical injury (22.8%) and vernal keratoconjunctivitis (21.1%) were the most common ocular surface disorders. The common indications for applying TCLs were to alleviate pain and discomfort (31.5%) and corneal thinning impending to perforation (26.3%). Subjects' clinical conditions and symptoms were resolved partially to completely in 89.4%. Dry eye was a common cause of contact lens associated therapeutic failure.

Conclusion: Poly-2-hydroxy ethyl methacrylate contact lenses are safe and effective in alleviating symptoms and healing of various ocular surface disorders in Nepalese population.

Key Words: Cornea, Therapeutic contact lens, Ocular Surface Disorders

Introduction

Contact lens can be used as a supplementary therapy in a variety of ocular surface disorders[1].Therapeutic use of contact lens is indicated in relieving pain in bullous keratopathy, superior limbic keratoconjunctivitis and laser refractive surgery; in promoting corneal wound healing in recurrent corneal erosion, traumatic corneal abrasion, persistent corneal epithelial defect, chemical injury, post-operative epithelial disorders, neurotrophic keratitis, and penetrating keratoplasty; in providing mechanical protection and support in corneal laceration, post surgical wound leakage, and corneal thinning; in maintaining corneal hydration in cicatrizing conjunctival diseases, chemical burns, eye lid defects, lagophthalmos, neuroparalytic keratitis, and dry eye; in improving vision in corneal irregularities, dry eye, and bullous keratopathy; and in sealing cornea in corneal laceration and perforation[1-5]. Though contact lenses have many therapeutic uses, success of contact lens use vary depending on type of ocular disorders, type of contact lens and evaluation criteria [6-8].

Though all types of contact lenses have therapeutic value, the therapeutic objectives and indications are the major factors behind the choice of lens [9]. Contact lenses made of hydrogel material are inherently flexible and have high oxygen permeability than those of hydrophilic lens. High oxygen transmissibility of this material ensures extended wear of contact lens, meeting critical oxygen demand of cornea and preventing over night corneal edema to

clinically acceptable level. Hydrogel lenses also rapids up corneal regeneration process during corneal healing and alleviates hypoxia related complications [10-12]. It has been five decades since the introduction of soft contact lens by Wichterle and Lim in 1960 with known advantages of hydrogel contact lens for therapeutic purposes in various corneal disorders but no study has been reported about the therapeutic effect of soft contact lens in context to Nepalese population. Therefore, this present study was carried out to determine the outcome of therapeutic contact lenses (TCL) application among Nepalese population in different ocular surface disorders.

Methods

All the patients with ocular surface disorders who were examined by ophthalmologists and referred to contact lens clinic of B. P. Koirala Lions Center for Ophthalmic Studies; a tertiary hospital in Kathmandu, Nepal, were evaluated for suitability of fitting TCL and those found suitable were fitted with TCL by an optometrist. A poly-2-hydroxy ethyl methacrylate (PHEMA) contact lens was applied in all the subjects on the affected eye. The lenses chosen had total diameter of 13.8mm, 70% water content, 8.6mm base curve, plano power and were to be applied on monthly replacement schedule. Lens fit was assessed 10-15 minutes after lens insertion and patients were followed up twice in a week and/or as per needed by the optometrist. Parameter for fit assessment included corneal coverage, centration and movement. Clinical condition of the eye was assessed by treating ophthalmologist on each visit. The usual concomitant therapies of antibiotics, steroids, or nonsteroidal anti-inflammatory drugs and artificial tears were prescribed by the ophthalmologist. Subjects who lost for follow up were excluded from analysis.

To evaluate both the clinical condition and subject's assessment of lens comfort, an examination protocol was added to the standard ophthalmologic examination. Slit-lamp examination included assessment of conjunctival hyperemia, limbal neovascularization, epithelial edema, corneal healing, and corneal transparency. Based on these assessments, the overall clinical condition was rated by investigators as restored to normal, partially improved, unchanged, or worse. The visual acuity was noted in Snellen fraction and paired t-test was done to assess the improvement in visual acuity during the first and final visit. Ethical approval was obtained from Department of Ophthalmology, Institute of Medicine, Nepal. Informed consent was obtained from patients and case report forms were completed by a cornea specialist for the initial treatment visit and the final visit.

Results

A total of 57 eyes of 55 patients (30 (54.5%) male and 25 (45.5%) female) were fitted with TCL. Mean age of the patients was 35.2 (SD 16.2) years. Patients were followed up on average for 11.5±47.9 days (range: 4 to 365 days) as per the requirement of the eye under treatment. Clinical conditions presented are summarized in Table 1.

Table 1. Duration of contact lens wear and improvement in visual acuity in different ocular surface disorders

Disease condition	n (%)	Duration of contact lens wear (Mean± SD*, days)	Improvement in visual acuity (Mean±SD, Snellen fraction)
Penetrating Keratoplasty	3 (5.3)	36.7±28.4	0.0
Saltzmann nodular degeneration	1 (1.8)	365	0.0
Corneal abrasion	5 (8.8)	13.2±10	0.2±0.3
Corneal Ulcer	8 (14)	14.5±7.1	0.0±0.1
Chemical Injury	3 (5.3)	9±1.7	0.4±0.3
Steven Johnson syndrome	3 (5.3)	7.3±5.8	0.1±0.2
Dry eye	7 (12.3)	7±2.6	0.3±0.1
Corneal Laceration (Mechanical injury)	13 (22.8)	11±8.4	0.1±0.2
Recurrent corneal erosion	2 (3.5)	8.5±2.1	0.3±0.3
Vernal Keratoconjunctivitis	12 (21.1)	11.5±7.3	0.2±0.2
Total	57 (100)	11.5±47.9	0.2±0.2

*SD= standard deviation

Corneal laceration due to mechanical injury (22.8%) followed by vernal keratoconjunctivitis (VKC, 21.1%) and corneal ulcer (including shield and metaherpatic ulcers) (14%) were the major clinical conditions.

TCL was applied primarily to relieve pain and discomfort in 31.5% cases followed by corneal thinning impending to perforation in 26.3%, and superficial punctuate keratitis (SPK) in 22.8% (Table 2).

Table 2. Indication for therapeutic contact lens use in ocular surface disorders

Ocular disorders	n (%)	Symblepharon	Corneal thinning impending to perforation	SPK**	Pain & discomfort	Corneal epithelial defect
Penetrating Keratoplasty	3 (5.3)	-	2 (3.5%)	-	-	1 (1.75%)
Saltzmann nodular degeneration	1 (1.8)	-	-	-	1 (1.75%)	-
Corneal abrasion	5 (8.8)	-	1 (1.75%)	-	3 (5.3%)	1 (1.75%)
Corneal Ulcer	8 (14)	-	6 (10.5%)	1 (1.75%)	1 (1.75%)	-
Chemical Injury	3 (5.3)	1 (1.75%)	-	-	1 (1.75%)	1 (1.75%)
Steven Johnson syndrome	3 (5.3)	2 (3.5%)	-	-	1 (1.75%)	-
Dry eye	7 (12.3)	-	1 (1.75%)	4 (7%)	2 (3.5%)	-
Corneal Laceration (Mechanical injury)	13 (22.8)	-	5 (8.8%)	1 (1.75%)	4 (7%)	3 (5.3%)
Recurrent corneal erosion	2 (3.5)	-	-	-	1 (1.75%)	1 (1.75%)
Vernal Keratoconjunctivitis	12 (21.1)	-	-	7 (12.3%)	4 (7%)	1 (1.75%)
Total	**57 (100)**	**3 (5.3%)**	**15 (26.3%)**	**13 (22.8%)**	**18 (31.5%)**	**8 (14%)**

**SPK= Superficial Punctate Keratitis

Improvement in corneal signs, conjunctival signs and subjects' response are reported in Table 3.

Table 3. Indication of therapeutic contact lens and recovery from ocular surface disorders

Indication for lens wear	Recovery			
	Restored to normal n (%)	Partially improved n (%)	Unchanged n (%)	Got worse n (%)
Symblepharon (n=3)	1 (33.3)	2 (66.7)	-	-
Corneal thinning impending to perforation (n=15)	6 (40)	7 (46.7)	2 (13.3)	-
SPK** (n=13)	5 (38.45)	5 (38.45)	1 (7.7)	2 (15.4)
Pain & discomfort (n=18)	12 (66.7)	6 (33.3)	-	-
Corneal epithelial defect (n=8)	6 (75)	1 (12.5)	1 (12.5)	-
Total (n=57)	**30 (52.6)**	**21 (36.8)**	**4 (7.0)**	**2 (3.5)**

**SPK= Superficial Punctate Keratitis

Pain and discomfort was found to be restored to normal in 66.7% and partially improved in 33.3% cases. Corneal thinning was prevented and restored to normal in 40%, and partially improved in 46.7% eyes. Corneal thinning did not improve in two cases (13.3%) of corneal ulcer. SPK was completely resolved in 38.4% and partially improved in 38.4% eyes. SPK did not improve in one eye (7.7%) of VKC and became worse in two eyes (15.4%) with dry eyes. A worse case of dry eye developed microbial keratitis. Because of frequent follow up, complication was controlled by timely treatment. Corneal epithelial defect was restored to normal in 75% and partially improved in 12.5%, however it did not improve in 12.5% subjects who primarily had chemical injury.

Visual acuity which is reported in table 1 was also rated as additional tool to assess improvement in ocular disorders. Mean visual acuity improved by 0.2±0.2 in Snellen fraction (p-value <0.05) from the first day to final day of TCL use.

Discussion

In this study, majority of subjects with various ocular surface disorders benefited from use of TCL where corneal laceration caused by mechanical injury (22.8%) and VKC have been identified as the most common conditions fitted with BCL for therapeutic purposes. According to various studies bullous keratopathy [13-15], post-operative kerato epitheliopathy[13], recurrent corneal erosion [15,16] and persistent epithelial defect [7,17] have been reported to benefit from TCL. The lens has primarily been indicated to alleviate pain and discomfort; and corneal thinning basically attributable to corneal laceration, corneal ulcers, and SPK (Table 2). Recovery of clinical signs and symptoms to normal (Table 3) was observed in 30 subjects (52.6%), and to partial in 21 subjects (36.8%). Though reports on the benefits of TCL vary, overall success of TCL has been reported in many literatures. In one report, moderate to significant pain relief was noted in 71% of the patients and significant improvement in visual acuity was noted in 51% [6]. In another report, 90% of patients with ocular surface disorder showed improvement in symptoms[8]. Overall success of TCL was reported to be 78% in one more study[7]. We have considered overall satisfaction of applying TCL in 89.4% of subjects. Our study has closely agreed the report of Gupta et al (1998) study for contact lens associated therapeutic failure in dry eye [18], where high water content hydrophilic contact lenses were applied for therapeutic purpose. This finding could partly be explained by the pervaporation of high water content contact lens over already compromised corneal surface.

A combination of unhealthy epithelium and overnight lens wear can predispose patients to limbal redness [19], bulbar and limbal redness [11], corneal edema [20], and a greater risk of infectious keratitis [21]. In our study, low incidence of microbial keratitis and symptomatic relief with improved epithelial healing by application of TCL helped in desired duration of lens wear. Although TCL wear is considered to be safe, complications are increasingly noted with longer follow ups and growing patient numbers [22, 23]. In our report, dry eye, Steven Johnson syndrome, and chemical injury required TCL for about one week and visual acuity was significantly improved in these cases (Table 1). At the same time, penetrating keratoplasty and Saltzmann nodular degeneration required TCL from a month to a year, however improvement in visual acuity was not observed.

Based on these findings, we suggest hydrogel contact lens to be highly effective in variety of corneal surface disorders in Nepalese population. However, a close follow up is mandatory to minimize the complication. A large study sample and preferably masked clinical trial is necessary to point out definitive advantages of TCL.

Conclusion

Poly-2-hydroxy ethyl methacrylate contact lenses improved various ocular surface disorders along with improvement in visual acuity in Nepalese population. Identifying indications as well as proper patient follow up and counseling are suggested as key factors for success of therapeutic use of contact lenses.

Conflict of interests: None declared.

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