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An Unusual Approach to Reduce Pain Following LASIK Surgery

LASIK Cerrahisi Sonrası Ağrıyı Azaltmak İçin Kullanılan Farklı Bir Yaklaşım

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ABSTRACT Objective: To evaluate the effectiveness of topical 0.4% ketorolac tromethamine usage with contact lenses following laser-assisted in situ keratomileusis (LASIK) surgery, for post-operative pain reduction. **Material and Methods:** Two hundred and ninety two eyes of 146 patients who underwent LASIK surgery under topical anesthesia were included in the study. Contact lenses soaked in a 0.4% solution of ketorolac tromethamine were applied to 148 eyes of 74 patients who had undergone LASIK surgery for refractive errors (Group 1). Contact lenses with no medication were applied to 144 eyes of 72 patients who had undergone LASIK surgery for refractive errors (Group 2). Pain scores were recorded in both groups every hour from hour 1 to hour 5, postoperatively. **Results:** There were no significant differences between the two groups with regard to age or sex (p>0.05). No significant difference was found between the two groups in respect of either preoperative or postoperative mean uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), and intraocular pressure values (p>0.05). The mean postoperative UCVA was significantly better than the mean preoperative UCVA in both groups (p<0.05). Pain scores for Group 1 patients at postoperative hours 2, 3, and 4 were significantly lower than for patients in Group 2 (p<0.001, p<0.001 and p=0.023, respectively). Topical ketorolac tromethamine did not negatively affect wound healing, corneal flap, or ocular surface in any patient. **Conclusion:** Topical ketorolac tromethamine application with contact lenses following LASIK surgery decreases pain and discomfort effectively.

Keywords: Ketorolac tromethamine; contact lens; keratomileusis, laser in situ; pain

ÖZET Amaç: Topikal %0,4 ketorolak trometaminin, "laser-assisted in situ keratomileusis (LASIK)" ameliyatlarında operasyon sonrasında kontakt lens uygulaması ile birlikte kullanılmasının, postoperatif ağrıyı azaltmasındaki etkinliğini değerlendirmek. **Gereç ve Yöntemler:** Topikal anestezi uygulanarak, LASIK operasyonu geçiren 146 hastanın 292 gözü çalışmaya dâhil edilmiştir. Refraksiyon kusuru için LASIK cerrahisi uygulanan 74 hastanın 148 gözüne, %0,4 ketorolak trometaminde ıslatılan kontakt lensler uygulandı (1. Grup). Refraksiyon kusur için LASIK cerrahisi uygulanan 72 hastanın 144 gözüne ise kontakt lens uygulaması yapılırken herhangi bir damla damlatılmadı (2. Grup). Operasyon sonrası 1. saatten itibaren başlayarak, 5. saate kadar her saat başı hastaların ağrı skorları kaydedildi. **Bulgular:** Yaş ve cinsiyet açısından iki grup arasında anlamlı bir farklılık yoktu (p>0,05). Ameliyat öncesi ve ameliyat sonrası ortalama düzeltilmemiş görme keskinliği (DGK), düzeltilmiş görme keskinliği (DÜGK) ve göz içi basıncı açısından anlamlı bir farklılık yoktu (p>0,05). Her iki grupta ameliyat öncesi DGK, ameliyat sonrası DGK'den anlamlı olarak daha yüksekti (p<0,05). Post-operatif 2, 3, 4 ve 5. saatlerdeki ağrı skorları Grup 1'deki hastalarda Grup 2'dekilere göre anlamlı olarak daha düşüktü (p değerleri sırasıyla p<0,001, p<0,001 ve p=0,023). Topikal ketorolak trometamin, hiçbir hastada yara iyileşmesini, korneal flebi ve oküler yüzeyi negatif yönde etkilemedi. **Sonuç:** Kontakt lens ile birlikte %0,4 ketorolak trometamin uygulanması, LASIK cerrahisi sonrasında ağrıyı ve rahatsızlığı etkin bir şekilde azaltmaktadır.

Anahtar Kelimeler: Ketorolak trometamin; kontakt lens; keratomilöz, lazer in situ; ağrı

Refractive errors are widespread and represent a significant health problem. The World Health Organization (WHO) reported 285 million people worldwide as having refractive errors.[1] Such errors are typically corrected by means of prescription glasses, contact lenses, intraocular lenses, or excimer laser therapy, with some therapeutic options being contraindicated in specific cases. Factors to be considered when opting for the most suitable method for each patient include socioeconomic status, age, and structure of the cornea, all of which must be reckoned.[2] Laser refractive surgery has of late become the treatment of choice for refractive errors, with approximately 1-2 million laser-assisted in situ ker-

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atomileusis (LASIK) operations being performed annually across Europe and the US.[3,4]

The International Association for the Study of Pain describes pain as an unpleasant sensation and emotional experience linked to tissue damage. This description aligns with LASIK surgery patients' experience post the procedure.[5,6] Inflammation occurs during surgery, when arachidonic acid is converted to prostaglandins mediated by cyclooxygenase (COX) enzymes. Non-steroidal anti-inflammatory drugs (NSAIDs) inhibit COX, reducing inflammation.[7,8] Previous studies have reported NSAIDs as having a maximal analgesic effect in the early post-operative phase, when pain is most intense.[9]

Some clinical studies have found topical ophthalmic NSAIDs to be effective for pain relief following ocular procedures such as refractive and cataract surgery, or due to corneal abrasions. NSAIDs are found in different generic forms; ketorolac tromethamine is among the most commonly used ophthalmic NSAID.[10-13]

In this study, we evaluated the effectiveness of topical 0.4% ketorolac tromethamine (Acular LS, Allergan, Ireland) usage with contact lenses following LASIK surgery, for relieving pain.

MATERIAL AND METHODS

The study protocol was approved by the local ethics committee (Necmettin Erbakan University Faculty of Medicine, Ethics Committee, Konya, Turkey, Project No:2020/2266). An informed written consent form was obtained from each patient before the surgery. The study complied with the tenets of the Declaration of Helsinki.

Between May 2019 and August 2019, contact lenses soaked in ketorolac tromethamine 0.4% solution were applied to 148 eyes of 74 patients subjected to LASIK surgery for refractive errors (Group 1). Contact lenses without any medication were applied to 144 eyes of 72 patients who had undergone LASIK surgery for refractive errors between May 2019 and August 2019 (Group 2). The study excluded patients who had any systemic or ocular diseases that might affect their vision. The mean age of the first group was 26.70±4.45 (20-35) years and 28.33±3.87 (22-34) years in the second group. Of 74 patients in the first group, 44 (59.5%) were males, while 30 (40.5%) were females. The second group had 42 (58.4%) males and 30 (41.6%) females.

Detailed ophthalmological examination, which included uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), intraocular pressure (IOP) measurement, refractive and topographic measurements, and biomicroscopic and fundus examinations, was performed both pre- and postoperatively.

All the surgeries were performed by a single surgeon (FU). Topical anesthesia with proparacaine HCI (Alcaine, Alcon, USA) was applied before the operation. Femtosecond laser system (Intralase, AMO, USA) was used for flap creation. The ablation was performed by Excimer laser system (VisX Star, S4, IR, AMO, USA).

After the procedure, contact lenses soaked in ketorolac tromethamine 0.4% solution were applied to the eyes of the Group 1 patients. Contact lenses without medication were applied to the eyes of the patients in Group 2. Post-operative, pain scores were recorded hourly for both groups, from hour 1 to hour 5. Patients scored their pain between 1 and 10 points, and according to these results a pain scale was developed for each patient.

Following the operation, patients used a topical antibiotic (moxifloxacin 0.5%, Vigamox®, Alcon, USA) 4 times a day for one week, topical steroid (loteprednol etabonate 0.5%, Lotemax®, Bausch & Lomb, USA) 4 times a day over two weeks, and a preservative-free topical lubricating drop (Na hyaluronate 0.15%, Eyestil®, SIFI, Italy) 4 times a day for 3 months. Follow-up examinations were carried out at day 1, week 1, month 1, month 3, and month 6.

STATISTICAL ANALYSIS

Statistical analysis were performed by using SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp). Data comparison was made using chi-square test, paired t-test, and t-test. A $p<0.05$ value was deemed statistically significant.

RESULTS

There were no significant differences between the two groups in respect of age or sex (p>0.05). The two groups did not differ significantly with regard to either preoperative or postoperative mean UCVA, BCVA, and IOP values (p>0.05). The mean postoperative UCVA was significantly better than the mean preoperative UCVA in both groups (p<0.05). Table 1 presents the preoperative and postoperative findings of the patients.

The mean pain score of the first group at postoperative hour 1 was 0.69±0.66 (0-2) and 0.54±0.50 (0-2) (p=0.826) for the other group. The difference was not significant, possibly due to the extended effect of the preoperative topical anesthesia.

However, at postoperative hours 2, 3, and 4, the mean pain scores of the first group were significantly lower than among the second group (p<0.001, p<0.001 and p=0.023, respectively). The mean pain score of the first group at postoperative hour 5 was not significantly different from that of the second group (p=0.414); this may have been due to the reduction of pain with the passage of time. The mean pain scores of the second group at postoperative hours 1 and 5 were significantly different from the pain scores at postoperative 2, 3, and 4 hours (p=0.021). However, that difference was not signifi-

TABLE 1: Preoperative and postoperative findings of the patients.

	Contact Lens with Ketorolac Tromethamin 0.4% (Group 1) (n=74)	Standalone Contact Lens (Group 2) (n=72)	p value
Age (y)	26.70±4.45 (20-35)	28.33±3.87 (22-34)	0.332
Sex (Male/female ratio)	44/30 (59.5%-40.5%)	42/30 (58.4%-41.6%)	0.426
Preoperative IOP	12.97±2.33 (10-17)	14.88±2.12 (11-18)	0.183
Postoperative IOP	15.27±2.43 (11-19)	13.72±2.59 (11-18)	0.221
Preoperative UCVA (logMAR)	0.68±0.18 (0.40-1.0)	0.73±0.20 (0.30-1.0)	0.242
Postoperative UCVA (logMAR)	0.00±0.24 (-0.10-0.10)	0.00±0.18 (-0.10-0.00)	0.824

y: Year; IOP: Intraocular pressure; UCVA: Uncorrected visual acuity; logMAR: Logarithm of the minimum angle of resolution.

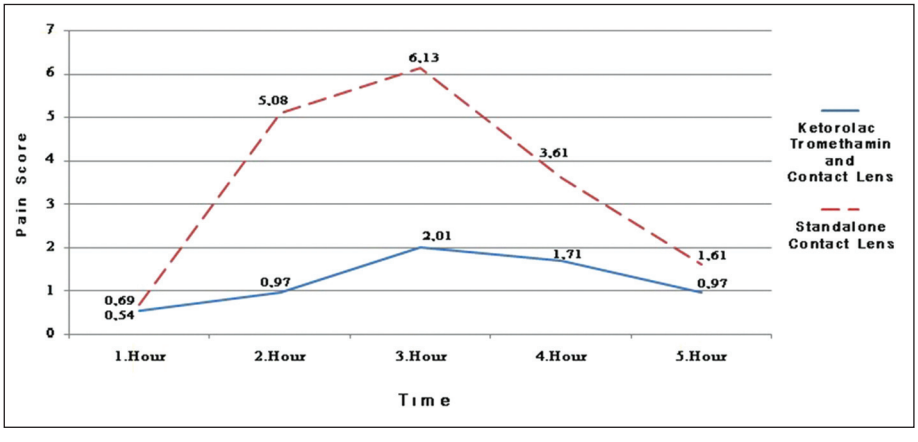

FIGURE 1: The mean postoperative pain scores of the patients.

cant in the first group (p=0.765). Postoperative mean pain scores for both groups are shown in Figure 1.

On the first postoperative day, all the patients' contact lenses were removed. There were no variations between the two groups in respect of flap appearance, wound healing, or ocular surface.

DISCUSSION

The cornea is quite sensitive to pain, given its dense neural network.[13] Laser surgery treats refractive errors and provides good vision, but pain in the early postoperative period results in discomfort for the patient; our aim was to decrease this pain. Pain after LASIK surgery is caused by the damage to the corneal epithelial layer and due to the wound-healing process.[14,15]

All topical NSAIDs inhibit COX-1 and COX-2, thereby blocking production of prostaglandins.[16] Ketorolac tromethamine is more selective for COX-1.[17] Ketorolac tromethamine 0.4% is FDA-approved and is widely used in postoperative studies.[7,16] However, we encountered no literature touching upon this particular NSAID's use with contact lenses following LASIK surgery, although Shetty et al. did evaluate the effect of a bandage contact lens soaked in ketorolac ophthalmic 0.45% solution (Acuvail) on pain modulation in patients undergoing transepithelial photorefractive keratectomy (PRK).[18] They concluded that a bandage contact lens soaked in ketorolac 0.45% solution can act as a potential drug depot, serving to mitigate pain following transepithelial PRK.

Dougherty used ketorolac tromethamine 4 times a day for 2 days before LASIK surgery and reported observing that the postoperative pain scores of patients were significantly lower than those of a control group.[14]

Price and Price reported that patients administered ketorolac tromethamine experienced 'no pain' or 'slight pain' post surgery, and the visual outcomes of this group reflected no statistical difference from those of the control group.[12]

In our study, we observed that the pain scores of the patients whose contact lenses were soaked in ketorolac tromethamine solution were not statistically different from the control group at postoperative hours 1 and 5. However, the pain scores of the first group at postoperative hours 2, 3, and 4 were significantly lower than those of the second group.

Systemic side effects of topical NSAIDs, such as exacerbation of bronchial asthma, are rarely observed.[19-21] Transient burning, itching, and conjunctival hyperemia are the most commonly encountered local side effects for topical NSAIDs; bulbar conjunctival edema, eyelid edema, and erythema could also be seen occasionally.[22,23] Although we encountered no systemic or local side effects in our patients, we recommend using this agent conservatively.

CONCLUSION

Topical ketorolac tromethamine usage together with contact lenses following LASIK surgery decreases pain and discomfort effectively.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Fikri Uçar;* ***Design:*** *Fikri Uçar;* ***Control/Supervision:*** *Servet Çetinkaya, Lütfi Seyrek;* ***Data Collection and/or Processing:*** *Fikri Uçar;* ***Analysis and/or Interpretation:*** *Fikri Uçar, Servet Çetinkaya;* ***Literature Review:*** *Fikri Uçar;* ***Writing the Article:*** *Fikri Uçar, Servet Çetinkaya, Lütfi Seyrek;* ***Critical Review:*** *Servet Çetinkaya, Lütfi Seyrek;* ***References and Fundings:*** *Fikri Uçar;* ***Materials:****Fikri Uçar.*

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