Surgically-İnduced Astigmatism After Transconjunctival Sutureless Vitrectomy

Transkonjonktival Sütürsüz Vitrektomi Sonrası Cerrahinin Neden Olduğu Astigmatizma

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ABSTRACT

Purpose: To evaluate surgically-induced astigmatism (SIA) in patients underwent 23 g transconjunctival sutureless vitrectomy (TSV).

Material and Methods: Thirty eyes of thirty patients who had 23 g TSV surgery were included the study. All patients were examined at pre-operative, first week, first month and third month after operation. Corneal topographies were obtained and pre- and post-operative corneal astigmatism values were also measured. SIA was calculated by using pre- and post-operative corneal astigmatism values and axises with the method which developed by Jaffe and Clayman.

Results: Post-operative mean SIA values were 0.67±0.34 (0.10-1.75) D, 0.4±0.23 (0.07-1.20) D and 0.22±0.16 (0.01-0.91) D at time points of first week, first month and third month, respectively. The decrease in SIA values through follow-up period was statistically significant ($p<0.05$) In the post-operative period, oblique astigmatism increased and irregular astigmatism decreased, but these changes were not statistically significant ($p>0.05$). Seventeen (81%) of 21 eyes with a shift to another meridian at post-operative first week returned normal values in time.

Conclusion: SIA is a side-effect that overshadow the surgical success on visual acuity and quality. In our study it was found to be statistically significant decrease in the values of SIA after the post-operative first week. As a result, we consider that 23 g TSV provides better final refraction and visual acuity values for the patients.

Key Words: Corneal topography, surgically-induced astigmatism, 23 gauge transconjunctival sutureless vitrectomy.

ÖZ

Amaç: 23 gauge (g) transkonjonktival sütürsüz vitrektomi (TSV) sonrası cerrahinin neden olduğu astigmatizmayı (CNA) değerlendirmek.

Gereç ve Yöntem: Çalışmaya 23 g TSV ameliyatı uygulanan 30 hastanın 30 gözü dahil edildi. Hastalar ameliyat öncesi ve ameliyat sonrası 1. hafta, 1. ay ve 3. aylarda değerlendirildi. Kornea topografisi çekilerek ameliyat öncesi ve sonrası astigmatizma değerleri ölçüldü. CNA değerleri, ameliyat öncesi ve ameliyat sonrası astigmatizmanın yönü ve büyüklüğü değerlerinin kullanıldığı, Jaffe ve Clayman tarafından geliştirilen yöntemle hesaplandı.

Bulgular: Ameliyat sonrası ortalama CNA değerleri 1. hafta, 1. ay ve 3. ayda sırasıyla 0.67±0.34 (0.10-1.75) D, 0.4±0.23 (0.07-1.20) D ve 0.22±0.16 (0.01-0.91) D idi. Takip süresi boyunca CNA değerlerindeki azalma istatistiksel olarak anlamlı idi ($p<0.05$). Ameliyat sonrası dönemde oblik astigmatizmanın arttığı, düzensiz astigmatizmanın azaldığı, ancak bu değişikliklerin istatistiksel olarak anlamlı olmadığı saptandı ($p<0.05$). Ameliyat sonrası 1. haftada astigmatizma aksında başka meridyene kayma saptanan 20 gözün 17'sinde (%81) aksın ameliyat öncesi meridyene döndüğü saptanmıştır.

Tartışma: CNA, cerrahi başarının görme keskinliği ve görme kalitesi üzerindeki etkisini gölgeleyebilecek bir yan etkidir. Çalışmamızda ameliyat sonrası 1. haftadan sonra CNA değerlerinde istatistiksel olarak anlamlı azalma olduğu saptanmıştır. Sonuç olarak, 23 g TSV cerrahisinin, nihai refraksiyon ve görme keskinliği değerlerinin daha iyi olmasına imkan sağladığını düşünmekteyiz.

Anahtar Kelimeler: Kornea topografisi, cerrahinin neden olduğu astigmatizma, 23 g transkonjonktival sütürsüz vitrektomi.

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INTRODUCTION

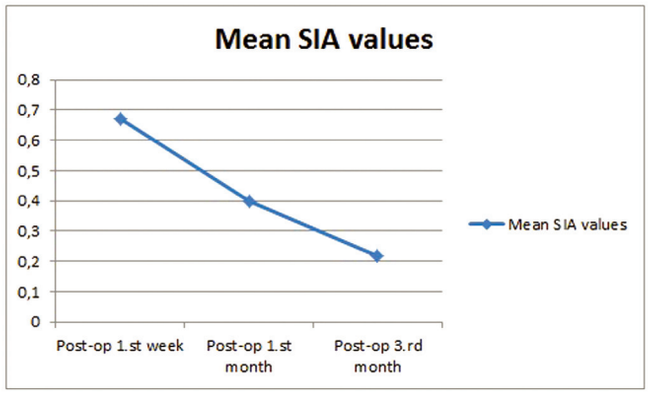
Considering the pathologies that require vitrectomy, the quality of visual acuity is as important as at least post-operative anatomical success. With the development of new microsurgical instruments, 25 gauge (g) transconjunctival sutureless vitrectomy (TSV) technique has been preferred to conventional 20 g vitrectomy in vitreoretinal surgery, and favorable results were reported in various vitreoretinal disorders.[1,2] 25 g TSV system is a less invasive method. The process involves less conjunctival and scleral manipulation, less corneal astigmatism due to the sutureless closure of sclerotomy sites, and also less post-operative inflammation and irritation.[3,4] Limbal stem cells are not harmed, because conjunctival detachment is not performed. This is especially important for individuals with dry eye and glaucoma. However, excess flexibility of 25 g instruments, and complications such as post-operative hypotonia, choroidal damage, leakage of tamponade substances lead to a draw back from transconjunctival sutureless vitrectomy.[5,6] It has been considered that these complications might be stemmed from lengthened surgery time and manipulation of surgical instruments at sclerotomy sites. In fact, Claus Eckardt developed 23 g TSV system in the year 2005 and overcame these problems by using more durable and stable instruments.[7] Astigmatism after vitrectomy is an acceptable consequence of vitrectomy.[8-11] If surgically-induced astigmatism (SIA) is minimum, optimal visual acuity and refraction may be obtained. In this study, we evaluated SIA in patients who underwent 23 g TSV.

MATERIAL AND METHODS

This retrospective study was conducted on patients who had 23 g TSV by the same surgeon between March 2009 and November 2009. 30 eyes of 30 patients were included the study. Vitrectomy indications were vitreous hemorrhage in 9 (30%) patients, rhegmatogenous retinal detachment in 6 (20%) patients, proliferative diabetic retinopathy in 5 (16.6%) patients, macular hole in 4 (13.4%) patients, epiretinal membrane in 4 (13.4%) patients, vitreomacular traction in 1 (3.3%) patient and persistent diabetic macular edema in 1 (3.3%) patient. Exclusion criteria were previous intraocular surgery, corneal pathologies, low visual acuity that prevented adequate fixation during corneal topography imaging, cataract that obstacle visualisation of fundus, cataract surgery together with vitrectomy, intraocular pressure values without normal limits before and after surgery (<8 and >21 mmHg), patients that require a second intervention within three months after surgery, and loss of the follow-up period. Pre-operative assessment of all patients included visual acuity, biomicroscopic examination, intraocular pressure measurement by Goldmann applanation tonometry, fundus examination and otorefractometry-keratometry measurements. In addition, corneal topographies were also obtained. When the fundus imaging failed, B-mode ultrasonographic imaging was performed. Otorefractometry-keratometry measurements were performed by using Topcon KR-8100 A device, and corneal topography was performed by using NIDEK Technology Japan device. The same surgeon performed all surgical procedures. Conjunctival insertion sites were inferior-temporal (infusion orifice), superior-temporal and superior-nasal areas. A special pressure plate and 23 g 45º angled knife (width: 0.72 mm) were used for a 10-15 degrees angled incision from 3-3.5 mm behind the limbus. Silicone oil was placed into 8 eyes (26.7%). C_2F_6, C_3F_8 and SF_6 gases were injected into 4 (13.3%), 2 (6.7%), and 2 (6.7%) eyes, respectively. 14 (46.6%) eyes were not required any tamponade substance. At the end of operations, sclerotomies of all patients were not closed by using sutures or scleral cauterization. The conjunctiva was pushed laterally using a cotton–wool applicator. All patients were visited at the first week, first month and third month after the operation and besides routine examinations, corneal topographies were also obtained. In addition to keratometry values in topography, pre- and post-operative corneal astigmatism values were also measured. SIA was calculated by using pre- and post-operative corneal astigmatism values and axises with the method which developed by Jaffe and Clayman. The astigmatisms with a vertical axis between 70-110° were accepted as regular, whereas astigmatisms with a vertical axis between 160-20° were accepted as irregular. Astigmatisms which were out of the limits 70-110° and 160-20° were accepted as oblique astigmatism. Informed consent was obtained from all of the patients. The procedures of the study were approved by the institutional review board of the hospital and adhered to the tenets of the Declaration of Helsinki. All data were inserted into a computer file for statistical analyses and Statistical Package for Social Sciences for Windows 17.0 (SPSS17inc) was used to perform Wilcoxon signed ranks test.

RESULTS

Study group consisted of 10 (33.3%) male and 20 (66.6%) female patients. The mean age was 58.6±11.5 years (range, 22-80 yr). The changes in SIA were measured post-operatively at time points of first week, first month and third month. Post-operative mean SIA values were 0.67±0.34 (0.10-1.75) D, 0.4±0.23 (0.07-1.20) D and 0.22±0.16 (0.01-0.91) D at time points of first week, first month and third month, respectively. The decrease in SIA values through follow-up period was statistically significant ($p<0.05$), (Graphic).



Graphic: *The post-operative change in surgically-induced astigmatism.*

In the pre-operative period, 33.3% (n=10) of the patients had regular astigmatism, 36.7% (n=11) had oblique astigmatism, 30% (n=9) had irregular astigmatism, whereas in the postoperative period, 33.3% (n=10) had regular astigmatism, 46.7% (n=14) had oblique astigmatism, and 20% (n=6) had irregular astigmatism (Table). In the post-operative period, oblique astigmatism increased, and irregular astigmatism decreased, but these changes were not statistically significant (p>0.05). Seventeen (81%) of 21 eyes with a shift to another meridian at post-operative first week returned normal values in time.

DISCUSSION

Various studies showed that 20 g vitrectomy leads to significant change in the corneal contour and thus post-operative astigmatism.[10-14] 20 g vitrectomy-induced astigmatism is mostly reversible and resolves within 1 to 4 months after surgery. Increase in the astigmatism after surgery is considered as resulting from scleral cauterization and sealing sclerotomy areas by sutures.[10-12]

In the study of Wirbelauer et al.,[11] central corneal steepening after 20 g vitrectomy is reported to be between 1.2 D to 1.6 D at the first week after surgery and this transient change which is thought to caused by scleral sutures, lasts until third month. Since the development of sutureless vitrectomy, many studies investigated astigmatism resulting from 20 g pars plana vitrectomy (PPV) and 25 g TSV.[3,15]

Yanyalı et al.,[3] reported that no change in regular or irregular astigmatism after 25 g TSV. Kadonosono et al.,[15] reported that 25 g TSV resulted in significantly less astigmatism with respect to 20 g PPV at the first month after surgery. The difference between astigmatism values reduced and become insignificant in 6 months. 23 g TSV technique combines the advantageous features of 20 g and 25 g approaches. In the state of vertical sclerotomies in 20 g and 25 g, tangential transconjunctival scleral tunnels were formed. Tunnel cuts in 23 g are thought to lead minimal inflammation and corneal astigmatism.[7]

Park et al.,[16] compared SIA in patient groups who had phacoemulsification surgery and combined 20 g PPV and 23 g TSV. They performed phacoemulsification surgery with a 2.2 mm clear corneal cut without suture. In our study, we evaluated SIA only in phakic patients who underwent 23 g TSV. In the study of Park et al.,[16] SIA was 1.07±0.57 D (max.1.91 D) at the first week after surgery in patients who had 23 g TSV. They found that astigmatism gradually decreased and reached the mean values of 0.33±0.18 D at the third month. None of the patients showed astigmatism higher than 1.00 D at the third month. On the other hand, 20 g PPV patients showed 2.09±0.81 D (max. 3.63 D) astigmatism at post-operative first week. Similarly, astigmatism gradually reduced and reached 0.58±0.27 D levels at the third month after the surgery in this group. Three eyes had astigmatism above 1.00 D at the third month. At the all time points after surgery, 23 g group had significantly lower values when compared to 20 g group. This result was ascribed to sutureless sclerotomy and lack of scleral cauterization in 23 g group. Our results were lower than that of Park et al.[16]

Yanyalı et al.,[17] reported that post-operative mean SIA values decreased after the first day of the 23 g TSV surgery. They reported that 23 g TSV surgery does not induce significant changes in average corneal power, corneal surface cylinder, surface asymmetry index, and surface regularity index. Kim et al.,[18] reported that there are no significant changes after the first month of 23 g TSV surgery between the pre- and post-operative Sim K astigmatism or KP values. These results reveal that corneal surface and astigmatic changes are minor after 23 g TSV.

Table: *Pre- and post-operative astigmatism distribution.*

	Pre-operative	Post-operative 1.st week	Post-operative 1.st month	Post-operative 3.rd month
Regular astigmatism	n=10 (%33.3)	n=9 (%30)	n=10 (%33.3)	n=10 (%33.3)
Oblique astigmatism	n=11 (%36.7)	n=17 (%56.7)	n=16 (%53.3)	n=14 (%46.7)
Irregular astigmatism	n=9 (%30)	n=4 (%13.3)	n=4 (%13.4)	n=6 (%20)

Another consequence of corneal curvature change induced by sutures is the shift of axis to other meridians.[11,19,20] Park et al.,[16] reported axis shift to other meridians in 30 eyes. Later, axis was returned into pre-operative values in 12 (85.7%) eyes with 23 g TSV and in 7 (43.8%) eyes with 20 g PPV. In our study group, 21 eyes showed axis shift to other meridians. Of these, 17 eyes (81%) returned back to pre-operative values.

Surgically induced astigmatism is a side-effect that overshadow the surgical success on visual acuity and quality. Especially in patients with a high expectation for post-operative vision, a corneal astigmatism induced by surgery may negatively affect post-operative refraction and final visual acuity. Kumagai et al.,[21] in a long-term follow-up study of 190 eyes with macular hole (Stage 2-4) repair, reported that ≥6/12 visual acuity was ≥6/6 in 44% of the patients and ≥6/12 in 86% of the patients (average 0.12 logMAR). A similar successful visual acuity outcome was obtained in epiretinal membrane peeling, and the mean improvement in visual acuity was reported as 0.3 logMAR and the mean final visual acuity was reported as 6/12.[22] High visual acuity may cause underestimation of 0.22 D astigmatism, in fact higher astigmatism may be determined visually and may negatively affect the patient leading to adverse symptoms.

Astigmatism is an expected consequence of vitrectomy.[8-11,16] SIA has a more prominent effect on final visual acuity in pseudophakic patients with respect to phakic patients. Almost all patients who underwent vitrectomy develope cataract in the later period[23,24] and vitrectomy-induced astigmatism may be managed during cataract surgery. Unfortunately, any intervention aiming at correction of astigmatism developed after vitrectomy in pseudophakic patients is only an additional surgical procedure. Pseudophakic patients without a correction intervention should ensure astigmatism to some extent. For this reason, vitrectomy techniques that carry a lower risk for astigmatism should be preferred in pseudophakic patients.

The primary limitation of this study is the lack of patients who underwent standard 20 g vitrectomy and 25 g TSV. A comparison of SIA after 23 g TSV with 25 g TSV and 20 g vitrectomy would exhibit the differences between these systems more clearly.

As a result, SIA values reduce significantly after the post-operative first week of the 23 g TSV surgery. Thus, rapid visual rehabilitation, optimal final refraction, and better visual acuity values may be achieved for the patients with 23 g TSV surgery.

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