Refractive Stability After Cataract Extraction Using a 6.5–Millimeter Scleral Pocket Incision With Horizontal or Radial Sutures

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ABSTRACT

BACKGROUND: Radial suturing of 6.5-millimeter scleral tunnel incisions following cataract surgery can create significant with-the-rule astigmatism in the immediate postoperative period. Because of the significant visual distortion and slow visual recovery seen with radial suturing, this study was undertaken to compare two other suturing techniques which induce lesser amounts of with-the-rule astigmatism in the immediate postoperative period.

METHODS: The refractive behavior of eyes closed with loose radial sutures and with horizontal sutures was compared to the behavior of eyes closed with the more traditional “tight” radial sutures following phacoemulsification surgery.

RESULTS: Eyes sutured with loosely tied radial sutures demonstrated minimal with-the-rule cylinder immediately following surgery (1.25 D) and showed a more rapid stabilization of astigmatism than did the eyes tied with tight radial sutures, 2 months versus up to 6 months. However, the eyes tied with horizontal sutures, which showed no induced with-the-rule astigmatism at the time of surgery, showed even more rapid stabilization between 5 days and 1 month from the time of surgery.

CONCLUSION: To get the most rapid visual rehabilitation following cataract surgery, a wound closure which generates no induced with-the-rule cylinder such as horizontal sutures would be required. [J Refract Corneal Surg. 1994;10:339-342.]

RÉSUMÉ

INTRODUCTION: Il a été démontré que les sutures radiales des incisions sclérales en tunnel après la chirurgie de cataracte induisent un astigmatisme significatif qui se conforme à la règle dans la période post-opératoire immédiate. À cause de la distorsion visuelle et de la lente récupération de vision qui vont avec des incisions fermées ainsi, on a étudié deux autres méthodes de suture des incisions après l'extraction de cataracte.

MÉTHODES: Les propriétés réfractives des yeux fermés avec des sutures radiales lâches et avec des sutures horizontales furent comparées avec celles des yeux fermés avec les sutures radiales sécurises traditionnelles après la phaco-emulsification.

RÉSULTATS: Les yeux fermés avec des sutures radiales et lâches ont démontré très peu d'astigmatisme se conformant à la règle immédiatement après la chirurgie (1,25 D) et ont démontré une stabilisation rapide d'astigmatisme (2 mois) par comparaison avec les yeux suturés sûrement et radiairement (6 mois). Cependant, les yeux fermés avec les sutures horizontales, qui n'ont pas démontré l'induction d'astigmatisme se conformant à la règle, se sont stabilisés le plus rapidement, entre 5 et 30 jours post-opérativement.

CONCLUSION: La guérison visuelle après la chirurgie de cataracte est plus rapide dans le cas des fermetures qui n'entraînent pas d'astigmatisme, comme il semble avec les sutures horizontales. (Translated by Rob Mack, MD, Iowa City, Iowa.)

SOMMARIO

PREMESSA: È stato già dimostrato che la sutura radiale delle incisioni a tunnel sclerale dopo chirurgia della cataratta può provocare un significativo astigmatismo secondo regola nell'immediato periodo postoperatorio, che determina una significativa distorsione visiva e un lento recupero visivo osservato con le suture radiali. Questo studio è stato fatto allo scopo di comparare due altre tecniche di sutura che inducono minore astigmatismo secondo regola nell'immediato periodo postoperatorio.

METODI: Il comportamento refrattivo degli occhi suturati con sutura radiale allentata e con sutura
orizzontale è stato paragonato al comportamento di occhi suturati con la più tradizionale sutura serrata radiale dopo facoemulsificazione.

RISULTATI: Gli occhi suturati con sutura radiale allentata hanno dimostrato un minimo astigmatismo secondo regola immediatamente dopo la chirurgia (1.25 D) e hanno mostrato una più rapida stabilizzazione dell’astigmatismo di quanto hanno fatto gli occhi con sutura serrata radiale, a 2 mesi fino a 6 mesi. D’altra parte gli occhi suturati con sutura orizzontale, che non hanno mostrato astigmatismo secondo regola indotto dall’intervento, hanno mostrato una ancora più rapida stabilizzazione tra 5 giorni e 1 mese dalla chirurgia.

CONCLUSIONE: Da questi dati si può concludere che per ottenere la più rapida riabilitazione visiva dopo chirurgia della cataratta sarebbe indicata una sutura del taglio come quella orizzontale, che non genera astigmatismo secondo regola indotto. (Translated by Francesco Carones, MD, Milan, Italy.)

Previously, we examined the long-term refractive behavior of scleral pocket incisions following phacoemulsification surgery. Vector analysis of refractive results demonstrated a stable induced astigmatic change of 1.20 ± 0.60 diopters (D) from 6 months to 6 years postoperatively. During that study, all amounts of surgically-induced with-the-rule astigmatism seen 1 week postoperatively changed to a net against-the-rule astigmatism of approximately 1.00 D. Furthermore, the amount of with-the-rule astigmatism seen at 1 week had little bearing on the final astigmatic result, although the time for relaxation from the with-the-rule, surgically-induced astigmatism to against-the-rule was greater for those incisions that had the greater with-the-rule cylinder to begin with.

The current study was undertaken to see if, when a minimal amount of astigmatism is induced at the time of surgery, refractive stabilization, ie, visual recovery, due to wound associated astigmatism would occur more quickly, and if so, how rapidly would the astigmatism stabilize? Numerous authors are currently looking at alternative wound construction and sutureless surgery. However, the older sutured 6- to 6.5-millimeter wounds for PMMA lenses still offer a reasonable alternative with minimal induced astigmatism and a somewhat simplified surgical technique.

MATERIALS AND METHODS

A retrospective control patient population was used consisting of 17 consecutive eyes with 5-day, 1-month, 2-month, and 6-month to 1-year follow-up visits that underwent phacoemulsification surgery in 1985. At that time, the radial suturing technique utilized was such that the anterior and posterior scleral flaps were placed in apposition at the close of the procedure (radial tight group). This put enough tension on the wound in the immediate postoperative period to induce large amounts of with-the-rule astigmatism. A more recent prospective study of two additional groups of eyes was undertaken. The second group of eyes had horizontal sutures (horizontal group) and the third group had loose radial sutures (radial loose group) placed at the time of cataract surgery. These latter two groups of eyes came from 19 consecutive patients with 1-day, 1-month, 2-month, and 6-month to 1-year follow-up visits. All of these patients had one eye closed with horizontal sutures. Those patients within this group who had surgery in the fellow eye during the same general time period were closed with "loose" radial sutures such that little or no tension was placed on the scleral flaps.

All eyes underwent routine phacoemulsification surgery with intracocular lens implantation for the treatment of age-related cataract as previously described. All surgeries were performed by the same surgeon; 10-0 nylon sutures were used for all closures. The wounds were all 6.5- ± 0.25-millimeter chord length placed 1.5 ± 0.5 mm posterior and parallel to the surgical limbus. The radial suturing technique consisted of a shoe-lace suture with four crosses. The horizontal suture technique consisted of a figure-eight suture as described by Masket. No sutures were removed at any point during the course of the study. Astigmatic data were processed using vector analysis as described by Jaffe, although newer, similar analysis exists. The following convention was used for analysis and interpretation of the axis of the induced cylinder. Axis measurements between 0° and 30° and 150° and 180° were considered against-the-rule astigmatism and given a numerical axis value of −1.0. Axis measurements between 60° and 120° were considered with-the-rule astigmatism and given a numerical axis value of +1.0. All other axis measurements were considered indeterminate and given a numerical axis value of 0.0. Statistics were then performed on these converted numeric values of astigmatism. Summarizing this analysis, astigmatism values that approach −1 indicate a tendency toward against-the-rule astigmatism, whereas numbers that approach +1 indicate a tendency toward with-the-rule astigmatism.

Statistical significance was determined by using a Student t-test for comparison of means between study groups and paired t-test analysis when comparing different time points within each study group. A p-value of 0.05 or smaller was considered statistically significant.

Refractive data were measured in a refracting lane using a phoroptor except for the 5-day data which were obtained exclusively with an autorefractor (Topcon or Humphrey) and the 1-month data which were a mixture of lane and autorefractor.
Table
Postoperative Refractive Cylinder (D) in Three Suturing Techniques of 6.5-Millimeter Cataract Wounds

<table>
<thead>
<tr>
<th>Time After Surgery</th>
<th>No. of Eyes</th>
<th>Baseline Preoperative Cylinder</th>
<th>Power of Postoperative Cylinder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 Days</td>
</tr>
<tr>
<td>Horizontal</td>
<td>19</td>
<td>0.54 ± 0.77</td>
<td>1.30 ± 0.81</td>
</tr>
<tr>
<td>Radial “tight”</td>
<td>17</td>
<td>1.04 ± 1.15</td>
<td>2.95 ± 1.58</td>
</tr>
<tr>
<td>Radial “loose”</td>
<td>11</td>
<td>0.43 ± 0.37</td>
<td>1.25 ± 0.54</td>
</tr>
</tbody>
</table>

Axis of Postoperative Cylinder†

<table>
<thead>
<tr>
<th></th>
<th>No. of Eyes</th>
<th>Baseline Preoperative Cylinder</th>
<th>Power of Postoperative Cylinder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 Days</td>
</tr>
<tr>
<td>Horizontal</td>
<td>19</td>
<td>-0.68 ± 0.67</td>
<td>-0.53 ± 0.84</td>
</tr>
<tr>
<td>Radial “tight”</td>
<td>17</td>
<td>-0.41 ± 0.87</td>
<td>+0.88 ± 0.33</td>
</tr>
<tr>
<td>Radial “loose”</td>
<td>11</td>
<td>-0.55 ± 0.82</td>
<td>+0.36 ± 0.67</td>
</tr>
</tbody>
</table>

*Fellow eyes of horizontal eyes with “loose” radial suturing.
†Calculation based on conversions: 1.0 = with the rule (60° - 120°), 0.0 = indeterminate, -1.0 = against the rule astigmatism (150° - 180° or 0° - 30°).

results. All eyes were examined on each of the three postoperative time points, 5 days, 1 month, 2 months, and 6 months to 1 year.

**RESULTS**

The Table demonstrates the refractive astigmatic corrections seen in all eyes during this study. Data are presented for progressive measurements and then vector analysis is used to represent data at 5 days, 1 month, 2 months, and 6 months to 1 year postoperatively. The 5-day postoperative data demonstrate a significant amount of with-the-rule astigmatism for the tight radial suture patients, 2.95 D (mean) with a numerical axis value of +0.88. In contrast, both the horizontal sutures and the loose radial sutures demonstrate significantly less astigmatism, 1.30 D (mean) and 1.25 D (mean) respectively. In addition, eyes with the horizontal sutures demonstrated at 5 days a shift to against-the-rule astigmatism with a -0.53 numerical axis value. On the other hand, the eyes with loosely tied radial sutures still had with-the-rule astigmatism with a +0.36 numerical axis value. By 2 months, all three populations had a net induced cylinder of about 1.00 D (no statistically significant difference between the three populations). All had shifted against-the-rule at that time with numerical axis values of -0.8 except for the tightly sutured radial group which was still shifting in the against-the-rule direction with a +0.2 numerical axis value (statistically significant difference from both other groups).

**DISCUSSION**

The refractive analysis may be criticized because auto refraction data were combined with manifest refraction data. Even though the magnitude of the sphere and cylinder may be significantly different when comparing automated and manifest refractions, the axis of the cylinder is usually very similar. Since the data analysis is mainly concerned with the speed of against-the-rule shift, i.e., axis change versus time, this combination of data is justified and does not weaken the conclusions.

The net-induced astigmatism for all three groups of eyes was roughly 1.00 D. This is equivalent to the long-term astigmatic data previously presented which demonstrated a net long-term change of approximately 1.20 D in the against-the-rule direction.† Interestingly, the horizontal suture group had an immediate against-the-rule shift at 5 days which
was not statistically significantly different from the shift noted at any other time point even out to 6 months. In contrast, the axis shift for both the loose radial sutures and the tight radial sutures was statistically significantly different between 5 days and 1 month and again showed an almost equal, significant, difference between 1 month and 2 or 6 months/1 year. Although the eyes with loose radial sutures achieved refractive stability more quickly than the eyes with tight radial sutures, the eyes with horizontal sutures appeared to stabilize the most quickly, with no statistically significant change noted after 5 days. Previously reported data\(^1\) demonstrated that the final magnitude of induced astigmatism and against-the-rule shift was independent of the initial amount of induced with-the-rule astigmatism. The tighter wounds, ie, more with-the-rule astigmatism, all radially sutured, simply took longer to achieve their final refractive status, but the endpoint was always the same, ie, 1.20 D of induced change with a large negative numerical axis value, -0.8. In this article, using wounds with identical dimensions, this refractive endpoint was achieved much earlier with horizontal sutures and, therefore, this indicates that final visual rehabilitation, ie, dispensing eyeglass prescriptions, would be feasible within a week following cataract extraction with 6.5-millimeter wounds closed by horizontal sutures as compared to those eyes closed with radial sutures, which require 2 months (loose radial) or more (right radial) to achieve a stable refraction.

REFERENCES