Tips to Create Smooth Scleral Beds under Scleral Flaps: Theory and Preliminary Results

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Tips to Create Smooth Scleral Beds under Scleral Flaps: Theory and Preliminary Results

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Abstract

A surgical technique using a round-tip scarifier to create smooth scleral bed surfaces was postulated and performed on patients. During dissection in the right-handed direction, the blade should be rotated approximately 15° counter-clockwise around the axis of its handle from the bed-surface plane; the blade is then rotated clockwise for incision in the opposite direction. The handle is simultaneously set at approximately 15° from the scleral bed surface. When a thicker scleral flap is required during undermining, the blade is again relocated just posterior to the flap-bed angle, and dissection is resumed while the back edge of the blade is pushed into the bed more firmly. In each of 12 consecutive trabeculotomies performed by two surgeons, Schlemm’s canal was successfully identified using this technique.

Introduction

Identification of Schlemm’s canal is essential in glaucoma surgeries such as trabeculotomy ab externo [1], non-penetrating trabeculectomy [2] and viscocanalostomy [3]. To identify Schlemm’s canal easily, the surface of the scleral bed under the scleral flap should be flat and smooth. A rough-surfaced scleral bed often causes unfavorable intraoperative conditions such as unintentional exposure of the underlying ciliary body, which resembles the inner wall of Schlemm’s canal, and failure to find the scleral spur, a helpful landmark lying adjacent to the canal.

Smooth scleral beds are difficult to obtain and very few techniques to achieve this have been reported in the literature. Herein, we describe a specific technique to create flat and smooth surfaces on the scleral bed and uniform thickness of the overlying scleral flaps. We also present preliminary results.

Methods

A Grieshaber Ultrasharp Knife (No. 681.01, Alcon Laboratories Inc., Fort Worth, Texas) was used for scleral undermining. Inspite of the macroscopically asymmetric shape of its blade, either side can be directed forward because of its round tip.

First, a vertical incision of the preferred thickness is made outlining the scleral flap. Then, the edge of the scleral flap is retracted with toothed forceps during undermining: the flap is maintained at a right angle or greater to the scleral bed so that the surgeon can directly observe fibers that appear to bridge the surface of the scleral bed and the inside of the flap. While the scarifier is used to dissect the sclera in the right-handed direction, the blade should be rotated approximately 15° counter-clockwise around the axis of its handle from the bed-surface plane (Figure 1). The blade is then rotated clockwise for incision in the opposite direction. At the same time, the handle is set at approximately 15° to the scleral bed (Figure 2). As the scarifier moves to the right, dragging the back edge of its blade on the bed surface, the tip of the blade dissects the bridging fibers.

When a thicker scleral flap is required during undermining, the blade is again relocated just posterior to the flap-bed angle, and dissection is resumed while the back edge of the blade is pushed into the bed more firmly (Figure 3).

In this pilot study, either of two surgeons performed this technique. The senior of the two had experience with more than 80 glaucoma surgeries including scleral flap formation, and the other with five. Overall, 12 consecutive trabeculotomies in eight patients were performed using the technique to evaluate its efficacy. Informed consent was obtained from each participant before surgery. The mean age of the patients was 55 years, with a range of five months to 82 years of age. Phacoemulsification and intraocular lens implantation were combined in four eyes. Postoperative courses were observed for more than 12 months.

Results

In all 12 surgeries, both surgeons created smooth and flat scleral beds to find Schlemm’s canal and successfully thickened the scleral flap during undermining. The rotation of the blade was found to be essential in obtaining a smooth surface (Figure 4).
all the cases, intraocular pressure remained below 21 mmHg without any major postoperative complications for 1 year after the surgeries.

Discussion

Few reports in the literature describe detailed techniques for creating sclera flaps. Even Tanihara et al., who enthusiastically reported results of modern trabeculotomy, did not describe a technique for this [1]. In terms of intrascleral buckling for rhegmatogenous retinal detachment, Freeman and Tolentino noted that the blade of the scarifier should be kept tangential to the scleral bed for scleral undermining [4]. However, according to their method, even slightly inadequate positioning of the blade may cause unfavorable, excess incisions. For example, placing the blade in a plane either lower or higher than the ideal plane results in dissection of the inner surface of the flap or the ascending scleral slope before the flap-bed angle, respectively. Similarly, downward inclination of the blade plane leads to unintentional dissection of the bed surface (Figure 5). Compared with their method, our technique allows some leeway in the positioning of the blade.

Collagen fibers, providing the strength and resilience of scleral stroma, are grouped into dense superimposed lamellae, which run mostly parallel to the surface of the eyeball [5]. Therefore, it is assumed that undermining parallel to the scleral surface proceeds by dissecting the bridging fibers microscopically observed while the flap is everted; it is uncertain whether such fibers histologically crosslink the fibers parallel to the scleral surface.

Slightly distanced from the bed surface by the rotation of the blade (Figure 1), the tip of the blade dissects only the bridging fibers without damage to superficial fibers of the bed, although excessive rotation may interrupt the dissection. Also, by generating a difference in angle between the plane including the whole blade and the virtual plane in which the axis of the handle moves, the rotation suppresses unnecessary incision in the direction of the tip.

By maintaining the angle between the bed surface and the axis of the handle, the following edge of the blade makes contact with the bed surface during dissection (Figure 2); detachment of the blade from the bed surface or laying the handle down on the scleral bed plane may result in unstable movement of the blade.

Temporarily forming an ascending scleral slope toward the flap-bed angle, the technique to thicken the scleral flap presumably brings the blade tip into contact with the superficial fibers of the bed that are to be dissected (Figure 3).

This study is preliminary because no grading systems were employed to judge the effectiveness of the technique, and a limited number of patients were included. Future studies should address these issues as well as the reproducibility of the manual technique.

In the past, surgeons may have hesitated to introduce surgeries that require identification of Schlemm’s canal. We believe our preliminary results will encourage surgeons to develop and acquire a variety of new glaucoma surgical techniques. In addition, our specific technique is applicable to surgeries such as intrascleral buckling [4] and scleral shortening [6], because it provides scleral flaps of uniform thickness.

References

Illustrations

Illustration 1

Figure 1: The scarifier is rotated approximately 15° counter-clockwise around the axis of its handle from the bed-surface plane. This dissects the bridging fibers in the right-handed direction. Note that the leading edge is separated from the bed surface.

Illustration 2

Figure 2: In addition to the rotation of the blade, the handle is set at approximately 15° from the scleral bed. Note that the blade contacts both the bridging fibers and the bed.
Illustration 3

Figure 3: The technique to thicken the scleral flap. The back side of the blade is pushed into the bed surface just posterior to the flap-bed angle to provide contact between the tip of the blade and the bed surface (arrowheads).

Illustration 4

Figure 4: The surgeon’s perspective. An intraoperative scleral bed created in the right eye of a five-month-old male with bilateral congenital glaucoma. Note that the rough surface on the nasal side (arrows) was unintentionally created due to insufficient blade rotation.
Illustration 5

Figure 5: Unfavorable excess incisions easily made due to slightly inadequate positioning of the blade when the blade is intended to be tangential to the surface of the scleral bed.
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