European Journal of Ophthalmology / Vol. 17 no. 5, 2007 / pp. 702-708

Prognostic value of gonioscopy after deep sclerectomy

J. MORENO-MONTAÑÉS[1], G. REBOLLEDA[2], F.J. MUÑOZ-NEGRETE[2]

[1]Department of Ophthalmology, University Clinic of Navarra, Navarra University, Pamplona
[2]Ophthalmology Unit, Ramón y Cajal, Alcalá University, Madrid - Spain

PURPOSE. *To ascertain gonioscopic characteristics and identify prognostic indicators related to intraocular pressure (IOP) after deep sclerectomy (DS).*
METHODS. *A transversal, prospective, and nonselected study was performed in 106 eyes (95 patients) after DS. Three surgeons performed all the surgeries and the gonioscopic examination, using the same protocol including 13 gonioscopic data. These data were evaluated for an association with postoperative IOP and time after surgery.*
RESULTS. *A subscleral space was found in 91 eyes (85.8%), with visualization of the line of scleral flap in 48 eyes (45.3%). The trabeculo-Descemet membrane (TDM) was transparent in 46 eyes (43.4%), opaque in 4 cases, and pigmented in 18 eyes. This TDM was broken using Nd:YAG laser goniopuncture in 38 eyes (35.8%). Thin vessels around TDM were found in 58 eyes (54.7%), and blood remained in 25 eyes (23.5%). Gonioscopic variables significantly positively related with postoperative IOP were as follows: presence of subscleral space, scleral flap line view, and a Schwalbe line depressed. A narrow anterior chamber angle and iris synechia in TDM had a statistically significant negative effect on the postoperative IOP control. Similarly, eyes requiring Nd:YAG goniopuncture had a worse IOP control. The frequency of eyes with visible subscleral space and transparent TDM decreases with time after surgery (p=0.001).*
CONCLUSIONS. *A visible subscleral space was a gonioscopic sign positively related to IOP control after surgery, although it decreased with follow-up. Eyes with goniopuncture, postoperative narrow angle, and iris synechia had worse postoperative IOP control. Although new vessels in TDM were a common finding after DS, the authors did not find any association with postoperative IOP. (Eur J Ophthalmol 2007; 17: 702-8)*

KEY WORDS. *Deep sclerectomy, Glaucoma surgery, Gonioscopy, Nonperforating glaucoma surgery, Subscleral space, New vessels*

Accepted: March 12, 2007

INTRODUCTION

Deep sclerectomy (DS) is a nonpenetrating filtration procedure for the surgical treatment of glaucoma. The technique involves creating a DS with thinning of the adjacent trabeculum and limbal cornea. This results in filtration of aqueous from the anterior chamber into the subscleral and subconjunctival spaces without perforation of the anterior chamber or iridectomy. Different studies demonstrate a decrease of intraocular pressure (IOP) after this surgery with a low frequency of postoperative complications (1-6). However, the technique of nonpenetrating surgery is more difficult and requires a longer learning curve compared with trabeculectomy (7, 8).
Several reports have been published about the efficacy of IOP decrease after this surgical procedure (1, 4), and other aspects including learning curve characteristics (7), ultrabiomicroscopic (UBM) findings (9, 10), and postoperative inflammation (11). It has been published that the progressive worsening of postoperative IOP control may

1120-6721/702-07$15.00/0

be related to the decreased size of the subscleral lake (10, 12, 13). Although these data have been reported using ultrasound biomicroscopy, gonioscopy is a simpler and cheaper procedure to assess the presence of subscleral space. In addition, other gonioscopic variables could have an influence on postoperative IOP control. However, to our knowledge, there is only one article reporting the postoperative gonioscopic findings after this surgical technique (14). In our study we have evaluated patients with a previous DS in order to analyze several gonioscopic variables at different postoperative intervals and to look for any association with IOP control after DS.

MATERIALS AND METHODS

A transversal, prospective, and nonselected study was performed in order to evaluate the gonioscopic characteristics and their relationship with IOP control in patients who underwent a previous DS. Patients with DS in one or both eyes who were prospectively examined in two departments of ophthalmology during a 5-month period were included in this study. Only patients with at least 3 months between DS and gonioscopic examination were included.

All surgeries and gonioscopic examinations were performed by one of the three authors expert in gonioscopy and nonpenetrating glaucoma surgery. Thirteen data were prospectively registered during gonioscopy (Tab. I) and bleb morphology was noted as flat, diffuse, and cystic. The same doctors revised from patient charts several data, including IOP and glaucoma medications used before DS, glaucoma diagnosis, time between surgery and gonioscopic examination, surgery (DS or DS combined with other surgery), and complications during or after surgery.

Finally, a total of 106 eyes (95 patients) were included in the study. The median age was 75 years (interquartile range [IR]: 65 to 68). In women the median age was 76 (IR: 70.25 to 84) and in men 72 (IR: 64 to 78) (p=0.005). Demographic data and characteristics of the study population are shown in Table II. Most eyes had chronic open angle glaucoma (75.5%).

Surgical technique

DS surgery was performed using the surgical technique described by Mermoud and Schnyder (8). After dissection of a superficial scleral flap measuring 5 × 5 mm, a deep sclerokeratectomy was done by performing a second deep scleral flap (4 × 4 mm), and it was prolonged anteriorly 1 to 1.5 mm into clear cornea. The juxtacanalicular trabeculum and Schlemm's endothelium were then removed. Deep scleral flap was excised and an implant was

TABLE I - GONIOSCOPIC DATA EVALUATED

Angle aperture (Shaffer classification 0–IV)
Subscleral space lake (visible or not visible)
TDM goniopuncture
TDM appearance (transparent, pigmented, or opaque)
Presence of new vessels around TDM
Presence of new vessels in the TDM
Blood remains around TDM
Blood remains inside TDM
View of the line of scleral flap through the subscleral space
Extirpation of the juxtacanalicular portion of the Schlemm canal
Presence of a Schwalbe line depressed
Iris synechia (in the center and/or lateral to the TDM)
Localization of TDM (superior, superonasal, superotemporal)

TDM = Trabeculo-Descemet Membrane

TABLE II - DEMOGRAPHIC DATA AND CHARACTERISTICS OF THE STUDY POPULATION

Characteristics	No. (%)
Sex	
Female	52 (54.7)
Male	43 (45.3)
Eye	
Right	50 (47.2)
Left	56 (52.8)
Glaucoma type	
Primary open-angle	80 (75.5)
Pseudoexfoliative	10 (9.4)
Pseudophakic	5 (4.7)
Pigmentary	3 (2.8)
Chronic closed-angle	3 (2.8)
Other secondary open-angle glaucomas	5 (4.7)
Anesthesia	
Retrobulbar/peribulbar	74 (69.8)
Topical	29 (27.4)
General	3 (2.8)
Deep sclerectomy	
Single	32 (31.2)
Combined with phacoemulsification	74 (69.8)
Surgical site	
Superior meridian	100 (94.3)
Superonasal or superotemporal meridian	6 (5.7)

placed in the center of the DS in order to create a subscleral space. In all cases a SK-gel implant (3.5 mm Corneal Laboratoires, Paris, France) was inserted under the superficial scleral flap. Finally, the superficial scleral flap and conjunctiva were sutured. In 11 eyes (10.4%) an unintentional microperforation occurred in the trabeculo-Descemet membrane (TDM) without iris prolapse or iris synechia during DS.

In cases with combined cataract surgery a phacoemulsification and intraocular lens implantation were previously made through a temporal clear corneal incision.

Statistical analysis

All analysis was performed using the SSPS statistics program, version 13.0 (SPSS, Inc., Chicago, IL, USA). Longitudinal comparisons of IOP were made using the two-tailed Student test for paired samples. Non-parametric test provided significance comparing different variables. Comparison of number of glaucoma medications was tested with the Wilcoxon signed-rank test. The Pearson chi-square test was also used for data analysis. Values were expressed as medians and interquartile ranges (25 to 75). A p value of < 0.05 or less was considered statistically significant.

RESULTS

The median IOP before DS was 23 mmHg (IR: 19 to 27 mmHg), and the median number of glaucoma medications was 2 (IR: 1 to 2). After DS the median IOP was 14 mmHg (IR: 11 to 16 mmHg) (p=0.001). Thirteen eyes (12.3%) needed one type of topical drops for IOP control after surgery (Fig. 1).

Hyphema was found postoperatively in 13 eyes and it was resolved spontaneously in all of them. In one case a Tenon cyst was observed and it was resolved with needling and 5-FU injection. Moreover, postoperative injections of 5-FU (range 2–5) were performed in 11 eyes (10.4%) in order to reach the IOP objective. One case with postoperative inflammation was treated with intensified topical steroids. Another eye had a choroidal detachment that resolved with conservative treatment.

The bleb appearance was flat in 38 eyes (35.8%), diffuse in 56 eyes (52.8%), and cystic or microcystic in 12 eyes (11.3%).

Gonioscopic examination revealed a subscleral space in 91 eyes (85.8%), with visualization of the line of the scleral flap in 48 eyes (45.3%). The Schwalbe line was depressed in 30 eyes (28.3%). The TDM was transparent in 46 eyes (43.4%), pigmented in 18 eyes (16.9%), and opaque in 4 cases (3.7%). The TDM was broken due to Nd:YAG laser goniopuncture in 38 eyes (35.8%). A careful gonioscopic examination showed thin new vessels in 58 eyes (54.7%), and blood remained in 25 eyes (23.6%) around or inside the subscleral space (Fig. 2). The frequency of new vessels in patients with visible subscleral space was significantly higher (98.3%) than the frequency in patients with no space (1.7%) (p=0.001). However, bleb appearance had no influence on new vessels rate: 50% of eyes with flat bleb had new vessels. No differences in new vessels rate were observed taking into account sex, age, eye, glaucoma diagnosis, antimetabolite use, surgeon, kind of surgery, anesthesia, TDM goniopuncture, and interval between surgery and gonioscopy.

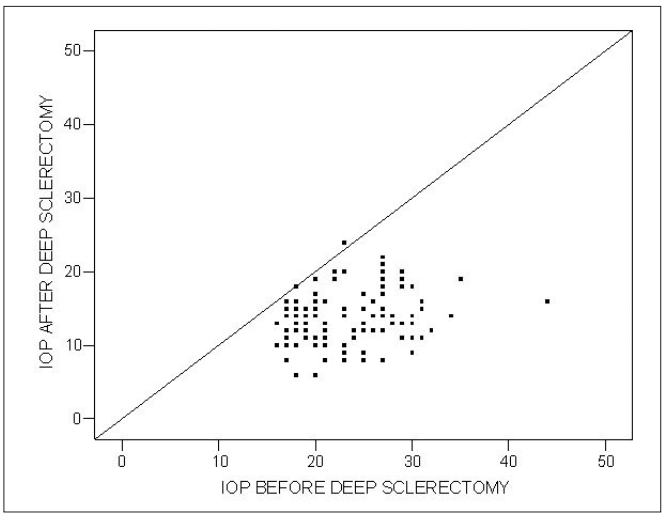

Fig. 1 - *Comparison of intraocular pressure after and before deep sclerectomy.*

The peripheral iris touched the TDM edge in seven eyes (Fig. 3), and the center in two cases. Nd-YAG laser was used only in one case with iris synechiae in the center of TDM in order to decrease the IOP. No relationship between iris synechia and unnoticed microperforation in the TDM during surgery was found.

Table III shows the relationship between several intraoperative and gonioscopic findings and the postoperative IOP. Presence of subscleral space, Schwalbe line depression, and view of scleral flap line through subscleral space have a significant positive effect on postoperative IOP. On the other hand, postoperative injections of 5-FU, Nd-YAG laser goniopuncture, iris synechia, and narrow angle have

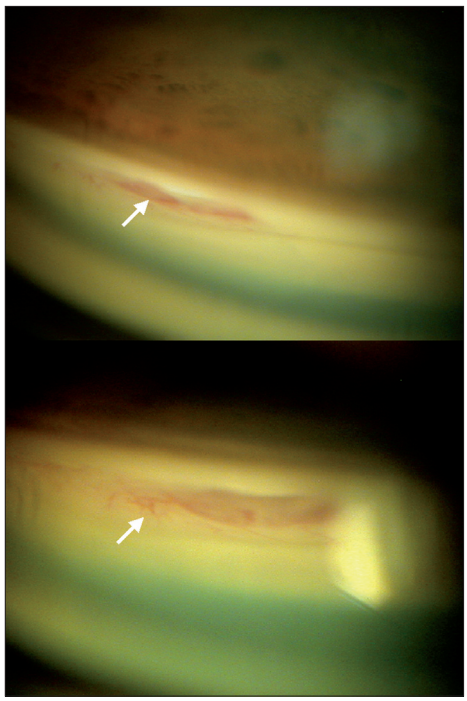

Fig. 2 - *Gonioscopic view of trabeculo-Descemet membrane after surgery. Two eyes with new vessels around the trabeculo-Descemet membrane (white arrows).*

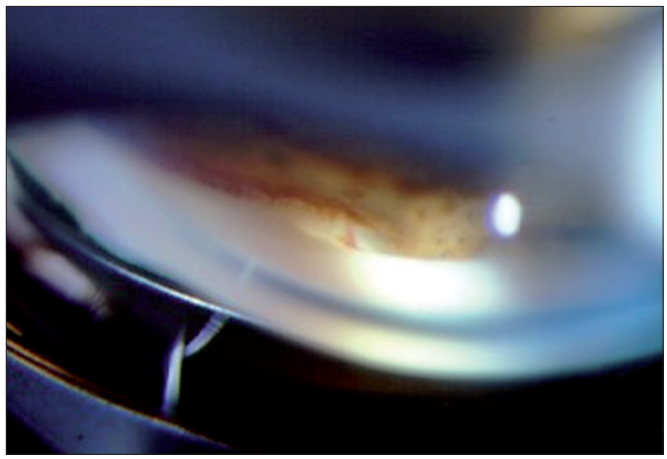

Fig. 3 - *Gonioscopic view of trabeculo-Descemet membrane after surgery. Iris synechia observed on lateral side of trabeculo-Descemet membrane.*

a negative relationship on IOP after DS. Eyes with flat bleb have higher IOP than eyes with other bleb appearance. No other gonioscopic sign was found related to postoperative IOP.

TABLE III - MEDIAN INTRAOCULAR PRESSURE (IOP) FOR SEVERAL RELATED FACTORS

Factor	No. eyes	IOP median (IR)	p
5-FU postoperative injection			
Yes	11	17 (14–20)	0.008*
No	95	13 (11–16)	
Bleb appearance			
Flat	38	14 (12.75–18.25)	0.001†
Diffuse	56	13 (11–16)	
Cystic	12	10 (8.25–12)	
Subscleral space			
Yes	91	13 (11–15)	0.001*
No	15	17 (14–20)	
Schwalbe line depression			
Yes	30	12 (10–15.5)	0.01*
No	76	14 (11–17)	
Scleral flap line view			
Yes	48	12 (10–15)	0.01*
No	58	14 (12–17)	
Nd–YAG goniopuncture			
Yes	38	15.5 (13.75–18.25)	0.001*
No	68	12 (10–14.75)	
Iris synechia			
Yes	9	19 (14–20)	0.007*
No	97	13 (11–15)	
Angle aperture			
Open	99	13 (11–16)	0.01*
Narrow	7	19 (13–20)	

*Mann-Whitney test.
†Kruskal-Wallis test

The median time between DS and gonioscopy examination was 12 months (IR: 5 to 23 months). We differentiated this time interval in three categories for statistical comparison: less than or equal to 1 year, between 1 and 2 years, and more than 2 years (Tab. IV). The presence of subscleral space with vision of scleral flap line and transparent TDM rates decreased after surgery (p=0.001). The rate of eyes with flat bleb increased significantly when interval between surgery and gonioscopy was longer than 1 year (p=0.001). The Nd:YAG laser goniopuncture increased from 17.6% after the first year to 69.6% after 2 years (p=0.001). The median postoperative IOP and number of glaucoma medications increased when time after surgery was longer than 2 years. The number of patients needing glaucoma medications increased from 1.9% at first year to 31.9% at the third year (p=0.001).

DISCUSSION

DS is a new surgical procedure for glaucoma surrounded by controversy regarding its IOP reduction efficacy compared to trabeculectomy. Most published reports comparing both surgical procedures show lower postoperative complications after DS with respect to trabeculectomy (1-6). However, we have previously described that complications are also higher if the DS is converted into trabeculectomy due to an inadvertent intraoperative macroperforation (15).

In this report, we have evaluated various gonioscopic data after DS in order to identify signs that could be related to postoperative IOP control. Until now, only one descriptive report of gonioscopy after DS has been published (14).

The importance of the subscleral lake in IOP reduction is well known (9, 10, 12). Remaining subscleral cavity has been found in 92.8% of eyes 1 year after surgery (10). The authors have proposed that the aqueous resorption may be different in the subscleral lake from that occurring in the subconjunctival bleb (10). In our study, eyes with visible scleral lake had better IOP control than eyes without scleral lake (p=0.001) and 65.8% of cases with subscleral lake had flat bleb. These findings suggest that the reabsorption may be made by another mechanism in cases with subscleral lake: i.e., new aqueous drainage vessels or an additional suprachoroidal outflow, as was proposed by Kazakova et al (10).

Park et al suggested that progressive decrease of the postoperative IOP reduction might be related to the decreased size of the subscleral lake (9). This finding has been reported with both hyaluronic acid and collagen implant (11, 12). Similarly, we have found that the number of eyes with subscleral space, flap line visualization, and Schwalbe line depression decreased with longer interval between surgery and gonioscopy, explaining why median postoperative IOP and number of glaucoma medications significantly increase with longer follow-up.

In our study, a high frequency of new vessels around or inside subscleral space was found. Recently, Vuori (14) reported gonioscopic findings of the TDM after a successful DS in 42 eyes; however, they did not mention any new

TABLE IV - INFLUENCE OF MEDIAN POSTOPERATIVE INTERVAL ON GONIOSCOPY FINDINGS

	0–12 Months after DS	13–24 Months after DS	>25 Months after DS	p
Eyes, n (%)	54 (100)	29 (100)	23 (100)	
IOP before DS, mmHg, median (IQR)	21 (18–26.5)	26 (20–29)	23 (20–27)	0.05*
IOP after DS, mm Hg, median (IQR)	12 (10–14.25)	15 (12.5–18.5)	15 (12–19)	0.001*
Eyes with topical treatment after DS, n (%)	1 (1.9)	3 (10.3)	9 (31.9)	0.001†
Subscleral space, n (%)	52 (96.3)	23 (79.3)	16 (69.6)	0.001†
Descemet window goniopuncture, n (%)	9 (17.6)	13 (44.8)	16 (69.6)	0.001†
Descemet window transparent, n (%)	34 (63)	7 (24.1)	5 (21.7)	0.001†
Vision of the line of scleral flap, n (%)	34 (63)	9 (31)	5 (21.7)	0.001†
Flat bleb, n (%)	10 (18.9)	16 (55.2)	12 (52.2)	0.001†
New vessels around Descemet window, n (%)	33 (61.1)	15 (51.7)	10 (43.5)	0.14†

*Kruskal-Wallis test.
†Chi-square linear-trend.
IOP = Intraocular pressure; DS = Deep Sclerectomy; TDM = Trabeculo-Descemet Membrane

vessels formation. There is evidence in animal models that new aqueous drainage vessels are produced after DS. Delarive et al. performed DS in rabbits, and 9 months after surgery they found new aqueous drainage vessels in the sclera adjacent to the dissection site (16). They also observed that the number of new aqueous drainage vessels in the operated area was higher in eyes with collagen implant than in eyes without this implant. In addition, the number of new drainage vessels in the operated sclera with or without implant was significantly higher than the number of drainage vessels recorded in the unoperated sclera. They concluded that the long-term increase in outflow facility might be partly explained by new drainage vessels surrounding the operated site. In our study, we observed new vessels in or around the subscleral space in 54.7% of cases with blood remains in 23.5%, and these vessels appeared only if the subscleral space existed. Although we have evaluated only the observable vessels on gonioscopy and we have not measured the outflow facility, we have not found a relationship between these new vessels and the IOP after DS. No demographic, preoperative, operative, or postoperative factors modified the new vessels frequency except the subscleral space persistence. In a previous published article, we reported some eyes with bleeding from these new vessels during gonioscopy even months after DS, and we recommended conducting a careful gonioscopic examination in patients who had undergone DS to avoid this complication (17). Ambresin et al reported one case of recurrent transitory hyphema with visual loss 6 years after DS with a collagen implant (18). They recommended reoperation with coagulation of the bleeding vessels surrounding the orifice of the Schlemm canal in cases of recurrent hyphemas. Our findings and those of other authors suggest that these new vessels are frequent after DS and might explain the decrease of IOP after surgery in eyes without a visible bleb. However, the mechanism implicated in new vessels formation remains to be elucidated in human eye.

In our study, other gonioscopic data such as a visible flap line and Schwalbe line depression were also significantly associated with better IOP control. Both data indicate a patent subscleral lake. To our knowledge these new signs are not previously described related with a low postoperative IOP.

Nd:YAG laser goniopuncture is a treatment to re-establish a useful filtration of aqueous humor through the TDM. Indications for Nd:YAG goniopuncture are changes in the TDM and an IOP increase and in our experience it must be performed only when a subscleral space is visible. Marchini et al described a small increase of this TDM thickness between months 1 and 12 using reticulated hyaluronic implant (12). The published frequency of goniopuncture is high in order to avoid the IOP increase some months after surgery (19). In our study the goniopuncture rate increases from 17.6% during the first year to 69.6% with follow-up longer than 2 years.

Iris synechia formation is one of the specific postoperative complications of this glaucoma surgical technique. This complication was associated with worse IOP control. When iris synechia are associated to IOP increase, treatment with miotics and laser should be given (20), although in many cases the laser treatment may break the TDM.

Several studies have suggested that MMC use during DS reduces postoperative IOP (6, 21, 22). In our study, median postoperative IOP was significantly lower in eyes that underwent DS with MMC application (p=0.006).

This study has several limitations. First, three different surgeons performed the surgical procedure and the gonioscopy. Secondly, we included cases with DS alone and cases with combined surgeries. On the other hand, various types of glaucoma are included. However, this clinical study was a prospective protocol looking for 13 gonioscopic signs, including a large number of eyes with several follow-up periods. Moreover, comparisons in gonioscopic findings taking into account variations in patient characteristics and glaucoma surgery have been performed to resolve these limitations. Despite these limitations, our clinical results have identified some positive prognostic indicators during gonioscopy, such as the presence of a subscleral lake, a visible flap line, Schwalbe line depression, and a transparent TDM. Negative signs were iris synechia to the TDM, a narrow postoperative angle, and TDM Nd:YAG goniopuncture.

We have confirmed the importance of the subscleral space in postoperative IOP control, although this space decreased months after surgery, justifying that goniopuncture rate and mean postoperative IOP increased with longer follow-up.

The frequency of new vessels in or around the TDM is high and was described in experimental studies in rabbits. These new vessels are related to the subscleral space and they not were related to postoperative IOP. Future reports will elucidate the role of these new vessels in postoperative IOP control.

ACKNOWLEDGEMENTS

The authors thank Maira Bes, PhD, from the Epidemiological Department of University of Navarra for valuable suggestions and assistance provided in statistical analysis of the data.

None of the authors has a financial, commercial, or proprietary interest in any product or surgical technique mentioned.

Reprint requests to:
Francisco J. Muñoz-Negrete, MD
Hospital Ramón y Cajal
Ophthalmology Department
Carretera Colmenar Viejo km 9, 1
E28034 Madrid, Spain
franciscojmunoz@telefonica.net

REFERENCES

1. El Sayyad F, Helal M, El-Kholify H, Khalil M, El-Maghraby A. Nonpenetrating deep sclerectomy versus trabeculectomy in bilateral primary open-angle glaucoma. Ophthalmology 2000; 107: 1671-4.
2. Shaarawy T, Karlen M, Schnyder C, Achache F, Sanchez E, Mermoud A. Five-year results of deep sclerectomy with collagen implant. J Cataract Refract Surg 2001; 27: 1770-8.
3. Ates H, Andac K, Uretmen O. Non-penetrating deep sclerectomy and collagen implant surgery in glaucoma patients with advanced field loss. Int Ophthalmol 2001; 23: 123-8.
4. Ambresin A, Shaarawy T, Mermoud A. Deep sclerectomy with collagen implant in one eye compared with trabeculectomy in the other eye of the same patient. J Glaucoma 2002; 11: 214-20.
5. Shaarawy T, Nguyen C, Schnyder C, Mermoud A. Comparative study between deep sclerectomy with and without collagen implant: long term follow up. Br J Ophthalmol 2004; 88: 95-8.
6. Cillino S, Di Pace F, Casuccio A, Lodato G. Deep sclerectomy versus punch trabeculectomy: effect of low-dosage mitomycin C. Ophthalmologica 2005; 219: 281-6.
7. Drolsum L. Conversion from trabeculectomy to deep Sclerectomy. Prospective study of the first 44 cases. J Cataract Refract Surg 2003; 29: 1378-84.
8. Mermoud A, Schnyder CC. Nonpenetrating filtering surgery in glaucoma. Curr Opin Ophthalmol 2000; 11: 151-7.
9. Park M, Tanito M, Nishikawa M, Chihara E. Ultrasound biomicroscopy of intrascleral lake after viscocanalostomy and cataract surgery. J Glaucoma 2004; 13: 472-8.
10. Kazakova D, Roters S, Schnyder C, et al. Ultrasound biomicroscopy images: long-term results after deep sclerectomy with collagen implant. Graefes Arch Clin Exp Ophthalmol 2002; 240: 918-23.
11. Chiou AG, Mermoud A, Jewelewicz DA. Post-operative inflammation following deep sclerectomy with collagen implant versus standard trabeculectomy. Graefes Arch Clin Exp Ophthalmol 1998; 236: 593-6.
12. Marchini G, Marraffa M, Brunelli C, Morbio R, Bonomi L. Ultrasound biomicroscopy and intraocular-pressure-lowering mechanisms of deep sclerectomy with reticulated hyaluronic acid implant. J Cataract Refract Surg 2001; 27: 507-17.
13. Chiou AG, Mermoud A, Underdahl JP, Schnyder CC. An ultrasound biomicroscopic study of eyes after deep sclerectomy with collagen implant. Ophthalmology 1998; 105: 746-50.
14. Vuori ML. Gonioscopic view of the trabeculo-Descemet's membrane after deep sclerectomy. Acta Ophthalmol Scand 2004; 82: 154-7.
15. Rebolleda G, Munoz-Negrete FJ. Comparison between phaco-deep sclerectomy converted into phaco-trabeculectomy and uneventful phaco-deep sclerectomy. Eur J Ophthalmol 2005; 15: 343-6.
16. Delarive T, Rossier A, Rossier S, Ravinet E, Shaarawy T, Mermoud A. Aqueous dynamic and histological findings after deep sclerectomy with collagen implant in an animal model. Br J Ophthalmol 2003; 87: 1340-4.
17. Moreno-Montañés J, Rodríguez-Conde R. Bleeding during gonioscopy after deep sclerectomy. J Glaucoma 2003; 12: 427-9.
18. Ambresin A, Borruat FX, Mermoud A. Recurrent transient visual loss after deep sclerectomy. Arch Ophthalmol 2001; 119: 1213-5.
19. Mermoud A, Karlen M-E, Schnyder CC, et al. Nd:YAG goniopuncture after deep sclerectomy with collagen implant. Ophthalmic Surg Lasers 1999; 30: 120-5.
20. Kim CY, Hong YJ, Seong GJ, Koh HJ, Kim SS. Iris synechia after laser goniopuncture in a patient having deep sclerectomy with a collagen implant. J Cataract Refract Surg 2002; 28: 900-2.
21. Anand N, Atherley C. Deep sclerectomy augmented with mitomycin C. Eye 2005; 19: 442-50.
22. Neudorfer N, Sadetzki S, Anisimova S, Geyer O. Nonpenetrating deep sclerectomy with the use of adjunctive mitomycin C. Ophthalmic Surg Lasers Imaging 2004; 35: 6-12.