Evaluation of the efficacy of collagen matrix implants (Ologen®) in comparison with mitomycin C for intraocular pressure reduction in phacotrabeculectomy

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Chair: Prof. Tomasz Żarnowski

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Searching for new modulators for wound healing in glaucoma filtering surgery

- Fibrosis of the subconjunctival tissue is the main reason of bleb failure and decreases the long-term success of antiglaucoma filtering surgery

- Antimetabolites (mitomycin C, MMC; 5-fluorouracil, 5-FU) decrease subconjunctival scarring and are used in order to enhance the efficacy of surgical glaucoma treatment
Searching for new modulators for wound healing in glaucoma filtering surgery

Possible complications caused by antimetabolites:

- Prolonged wound leakage
- Hypotony
  - Choroidal detachment
  - Maculopathy
- Thin, avascular bleb
- Bleb-associated infections
  - Blebitis
  - Endophthalmitis
A REPLACEMENT FOR ANTIMETABOLITES?
Biodegradable collagen matrix implant (Ologen®)

- Designed to improve the long term success of trabeculectomy by decreasing the subconjunctival scarring
- Porous porcine matrix of cross-linked atelocollagen (>90%) and glycosaminoglycan (<10%)
Biodegradable collagen matrix implant (Ologen®)

- Is available in two sizes:
  - 6 mm (D) x 2 mm (H)
  - 12 mm (D) x 1 mm (H)
- Is biodegradable in 90 – 180 days
- Much easier to place over the scleral flap with the small limbal incision – smaller diameter (D) and greater thickness (H)
- More difficult to visualize the sutures for laser suture lysis in the postoperative period
Mechanically separates the conjunctiva and episcleral surface and prevents adhesions between them.

Scaffold for growth of fibroblasts – promotes fibroblasts growth through the matrix pores in a random and diffuse manner.

Proper bleb formation by occupying the subconjunctival space.

Reservoir of aqueous humour:
- Provides resistance at the outlet of the scleral tunnel and thus prevents hypotony.
- Allows for dynamic scleral flap movement (advantage over fixed suture).

**Mechanisms of action of Ologen®**

**Volume of the implant**
- Porous structure

**COLLAGEN MATRIX (OLOGEN®) IN PHACOTRABECUCLECTOMY**
Purpose

To assess the efficacy and safety of collagen matrix implant (Ologen®; OLO) in phacotrabeculectomy and to compare with mitomycin C (MMC) augmented phacotrabeculectomy
Materials and methods

- Prospective randomized comparative study
- 20 eyes of 20 patients (16 women, 4 men; mean age 77.3 years) with cataract and:
  - primary open angle glaucoma (POAG) (13 eyes)
  - pseudoexfoliation (PEX) glaucoma (PEXG) (7 eyes)
- Phacotrabeceulectomy augmented with OLO (12 eyes) or MMC (8 eyes)
- Follow-up – 6 months

- There were no significant differences between OLO and MMC group in nuclear density of cataract (P=0.9018; Mann-Whitney U test).
Main outcome measures

- Mean intraocular pressure (IOP) before and after surgery
- Mean best corrected visual acuity (BCVA) before and after surgery (LogMAR)
- Evaluation of the bleb on the Moorfields bleb grading system (MBGS)
- Mean number of antiglaucoma medications used before and after surgery
- Grading the cataract on the lens opacities classification system III (LOCS III)

In the OLO group, the presence of collagen matrix implant was assessed using anterior segment optical coherence tomography (AS-OCT – Casia)
Surgical technique

**Phacotrabeculectomy with MMC**
- 2 releasable 10-0 Nylon sutures on both corners of the scleral flap + 1 fixed suture in the center
- MMC 0.3 mg/ml for 3 minutes under the scleral flap

**Phacotrabeculectomy with OLO**
- 2 releasable 10-0 Nylon sutures on both corners of the scleral flap (without central suture)
- Ologen® implant over the scleral flap
Biodegradable collagen matrix implant (Ologen®)

- Version 3, Aeon Astron
- Size: 6 mm (D) x 2 mm (H)
- Placed centrally over the scleral flap under the conjunctiva
- 2 releasable 10-0 Nylon sutures on both corners of the scleral flap (without central suture)

Postoperatively all patients were treated with 0.1% dexamethasone in tapering doses over 6 weeks and antibiotic 5 times a day for 10 days.
RESULTS
Mean reduction of intraocular pressure at 6 months after surgery. The mean reduction of IOP was slightly greater in the MMC group, but it wasn't statistically significant (p=0.468; Student’s t-test).

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean IOP before surgery (±SEM)</th>
<th>Mean IOP 6 months after surgery (±SEM)</th>
<th>% decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLOGEN</td>
<td>30.75 ± 2.25</td>
<td>14.58 ± 1.18 ***</td>
<td>52.6</td>
</tr>
<tr>
<td>MMC</td>
<td>33.25 ± 3.88</td>
<td>14.25 ± 1.21 ***</td>
<td>57.1</td>
</tr>
</tbody>
</table>

Student's t
* P<0.05, ** P<0.01, *** P<0.001
Mean improvement of BCVA at 6 months after surgery was slightly greater in the MMC group, but it wasn't statistically significant (p=0.4564; Mann-Whitney U test).

Wilcoxon signed-rank test; * P<0.05, ** P<0.01, *** P<0.001

COLLAGEN MATRIX (OLOGEN®) IN PHACOTRABECULECTOMY
### Mean number of antiglaucoma medications

<table>
<thead>
<tr>
<th></th>
<th>Mean number of antiglaucoma medications before surgery (±SEM)</th>
<th>Mean number of antiglaucoma medications 6 months after surgery (±SEM)</th>
<th>% decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLOGEN</td>
<td>1.25 ± 0.35</td>
<td>0.5 ± 0.29</td>
<td>60.0</td>
</tr>
<tr>
<td>MMC</td>
<td>0.63 ± 0.92</td>
<td>0.5 ± 1.07</td>
<td>20.6</td>
</tr>
</tbody>
</table>
Morphology of the filtering blebs in MBGS
Morphology of the filtering blebs in MBGS

There were no statistically significant intergroup differences in the area of the bleb during the follow-up (Mann-Whitney U test).
Morphology of the blebs (1-5) in MBGS

Area of the bleb (1–5)

Height of the bleb (1–4)

Vascularity of the bleb (1–5)

During the first 3 months of follow-up there were statistically significant differences in the height of the bleb (Mann-Whitney U test).

* P<0.05, ** P<0.01, *** P<0.001
There were no statistically significant intergroup differences in the vascularity of the bleb during the follow-up (Mann-Whitney U test).
Morphology of the filtering blebs after 6 months

<table>
<thead>
<tr>
<th></th>
<th>A (area) 6 months after surgery (±SEM)</th>
<th>H (height) 6 months after surgery (±SEM)</th>
<th>V (vascularity) 6 months after surgery (±SEM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OLOGEN</td>
<td>2.83 ± 0.37</td>
<td>2.00 ± 0.25</td>
<td>2.0 ± 0.0</td>
</tr>
<tr>
<td>MMC</td>
<td>3.00 ± 0.25</td>
<td>2.13 ± 0.23</td>
<td>2.0 ± 0.0</td>
</tr>
</tbody>
</table>

Mann-Whitney U test;
* P<0.05, ** P<0.01, *** P<0.001

6 months after surgery there were no significant intergroup differences in bleb area, height and vascularity.
Morphology of filtering blebs at 6 months after surgery using AS-OCT

OLO uniform bleb

OLO microcysts + subconjunctival separation

MMC microcysts + multiple layers

Ologen® implant was still present in 6 eyes (50%) after 90 days and in 3 eyes (25%) after 180 days postoperatively [AS-OCT Casia]

Morphology of filtering blebs at 6 months after surgery using AS-OCT

<table>
<thead>
<tr>
<th></th>
<th>OLO Number of eyes (%)</th>
<th>MMC Number of eyes (%)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniform</td>
<td>5 (41.7)</td>
<td>3 (37.5)</td>
<td>0.892</td>
</tr>
<tr>
<td>Multiform</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Microcysts + multiple layers</td>
<td>4 (33.3)</td>
<td>1 (12.5)</td>
<td>0.329</td>
</tr>
<tr>
<td>• Microsysts + subconjunctival separation</td>
<td>2 (16.7)</td>
<td>3 (37.5)</td>
<td>0.329</td>
</tr>
<tr>
<td>• Only microsysts</td>
<td>1 (8.3)</td>
<td>1 (12.5)</td>
<td>0.824</td>
</tr>
</tbody>
</table>

There were no statistically significant intergroup differences in bleb AS-OCT imaging after 6 months (Mann-Whitney U test).

In all OLO and MMC blebs the route beneath the scleral flap was visible.

Conclusions

Ologen® implant can be a new, safe and effective alternative to MMC with similar success rate at 6 months of follow-up

Further trials and longer observation are required to reveal differences between these two adjuvants
Conclusions

- IOP significantly decreased in both surgical groups
- BCVA remarkably improved in both surgical groups
- Within 3 months after surgery mean bleb height was significantly greater in the OLO group
- At 6 months of follow-up there were no significant differences in bleb area, height and vascularity between OLO and MMC groups
- None of the eyes in either group required any additional surgical intervention

Collagen Matrix (Ologen®) in Phacotrabeculectomy
Thank you for your kind attention