Efficacy of collagen cross linking (CXL) of human corneal transplants ex vivo: a pilot study.

Schmidinger G.¹, Lammer J.¹, Pircher N.¹, Fischinger I.²

¹Medical University of Vienna
²Inselspital Bern, Schweiz

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Background and Purpose:

Penetrating keratoplasty has proven to be a well established and safe procedure for several indications. Common complications involve graft rejection, post-OP astigmatism and melting of the graft.

Our hypothesis is that pre-operative (OP) crosslinking (CXL) of corneal transplants might result in a higher resistance against melting and a reduction of post-OP astigmatism of the graft.

Purpose of this study was to experimentally assess efficacy of ex-vivo collagen cross linking (CXL) in corneal transplants stored in tissue culture.
Materials and Methods:

• Human donor corneas that were stored in culture medium (Alchemia) were divided into 2 groups:

→ **Treatment group:**

  Riboflavin 0.1% + Dextran 20% was administered to the grafts for 30 minutes followed by 10 minutes of UV-A (365nm; 9mW/cm²) irradiation.

→ **Control group:**

  Grafts received sham treatment only (30 minutes of Riboflavin immersion, no irradiation).

• Pachymetry was assessed before and after treatment.

• Stress/Strain measurements of corneal stripes were performed using a custom made uniaxial material tester at strains up to 12%. ¹

Results

• Ten paired human donor corneas were included. Mean±SD of time in culture was 10.2±5.0 days. Corneas were stored in deswelling Tissue medium for 24-48 h before testing.

• There was no difference in corneal thickness between the two groups investigated.
Results

- Stress needed for a 10% strain was significantly increased by 34% in the treatment group compared to control.

- UV light absorption by storing medium B was negligible.

<table>
<thead>
<tr>
<th>Medium B</th>
<th>Time of graft in Medium B (in h)</th>
<th>pH</th>
<th>UV absorption at 365nm</th>
</tr>
</thead>
<tbody>
<tr>
<td>without corneal graft</td>
<td>0</td>
<td>7.7</td>
<td>0.025</td>
</tr>
<tr>
<td>with corneal graft</td>
<td>24</td>
<td>7.4</td>
<td>0</td>
</tr>
<tr>
<td>with corneal graft</td>
<td>96</td>
<td>6.8</td>
<td>0</td>
</tr>
</tbody>
</table>
Ex-vivo CXL of corneal grafts stored in organ culture Medium was successful in our experimental setting. Donor grafts showed significantly increased corneal rigidity. However, increase of corneal rigidity was lower than described for native corneas in the literature.

Given that UV light absorption of the used tissue medium at 365 nm was negligible, a lower riboflavin concentration due to medium saturation in the corneal tissue might be the cause.

Additional studies are underway to assess the introduced procedure in terms of endothelial safety, corneal transparency and reduction of suture induced corneal astigmatism.