A comparison between paragon slide rule and paragon topographer software in final lens choice

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A Comparison Between Paragon Slide Rule and Paragon Topographer Software in Final Lens Choice

By

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A thesis submitted to the faculty of the
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Biography

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Crist is in his fourth year of optometry school at Pacific University. He is an avid disc golfer from Big Bend City, Minnesota. After graduation, Crist intends to go into a private practice specializing in contact lenses.

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Abstract

Corneal Refractive Therapy has yielded fine results in correcting small to moderate myopia by redistributing corneal epithelial tissue. Currently there are two modalities to help the practitioner decide on his or her initial trial lens. The traditional trial lens slide rule calculator and the new Paragon CRT software for topographers were measured against one another in a retrospective study using twenty successful fits (40 eyes) with Paragon CRT. Overall depths of the trial lenses, as computed by both modalities, were compared to the overall depth of the final successful lens. The study found that the slide rule was slightly closer to the final lens depth. The significance of this finding is however small.
Acknowledgements

We would like to thank Pat Caroline for his guidance.
Introduction

Throughout the years, contact lens practitioners have been searching for a way to reshape the cornea without ablating tissue to assure reversal if so desired. In years past this has been achieved by wearing orthokeratology lenses during the day. Interest was low due to the need to wear initially uncomfortable rigid lenses to work or school. This has changed with Paragon CRT lenses, which are worn at night. With that advent, came more interest in reshaping corneas with rigid gas permeable contact lenses. To assist the practitioner in fitting these lenses, Paragon came up with two ways to select an initial trial lens. The first way is a slide rule where the practitioner adjusted the slide based on flat K and manifest refraction to obtain the initial lens. The second way is computer software for topographers, which use criteria unknown to the investigators.

Paragon CRT (Corneal Refractive Therapy) has three parameters the practitioner can manipulate in order to achieve the desired sagittal depth for proper treatment. The first is base curve of the lens. This parameter can be changed by tenths of millimeters resulting in a change in depth of 7 microns. The second parameter is landing zone angle, which can be changed by 1-degree increments, yielding changes of 15 microns in depth. The final parameter is return zone depth, which can be changed in increments of 25 microns. In the case of the former two parameters, making the lens steeper makes the lens have more sagittal depth.

This study is aimed at determining whether one modality was better at predicting the final sagittal depth of the lens that successfully corrected the patient’s myopia. If one modality was by far superior, practitioners would spend less time fitting and refitting lenses and the patient would have fewer visits to his or her practitioner’s office.
Methods

20 successful CRT fits from a private optometric practice were evaluated retrospectively with regards to final lens choice compared to slide rule lens choice and software lens choice. Requirement for the study was successful fitting of Paragon CRT lenses. Each subject was negative for any anterior segment pathology. Each final lens parameter was adjusted into an overall sagittal depth number. Base curve, landing zone angle, and return zone depth were compared between the slide rule or software and the final lens selected. Each parameter was compared individually.

The base curves of the selecting nomagrams were compared to the final lens and if the trial was flatter than the final lens it was given a negative depth number at the rate of 7 microns per tenth millimeter flat. Steeper lenses were given a positive number, with matching trial lenses given a zero. The results are as follows:

The average amount off the slide rule was from the final lens is .7 microns steeper than
the final lens choice. The average amount the software was from the final lens is 2.63 microns steeper than the final lens choice.

The next parameter investigated is the return zone angle. Again, trial lens angles that are steeper were given a positive number to correlate to a deeper sagittal depth. The results are as follows:

<table>
<thead>
<tr>
<th>Return Zone Angle</th>
<th>Depth Error From Final CRT Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>+4.3</td>
</tr>
<tr>
<td>20</td>
<td>-0.5</td>
</tr>
<tr>
<td>30</td>
<td>+0.7</td>
</tr>
<tr>
<td>40</td>
<td>-3.2</td>
</tr>
</tbody>
</table>

The slide rule was off by an average of 6.38 microns too steep and the software was off by an average of 3.38 microns too steep.

Finally the return zone depth was investigated. Here, if the nomogram selected a lens that was too deep it was given a positive value. The results are as follows:
The slide rule was off by an average of 3.13 microns too steep and the software was off by an average of 7.5 microns too steep.

After computing how much each individual parameter was off, the overall error and the absolute error as a whole of each modality was found. The results are as follows:
The slide rule gave a lens that was too steep by 10.2 microns on average. The software yielded a lens that was steeper by an average of 13.5 microns.

The final analysis reveals how close each modality is to selecting the proper lens by using only the amount of depth each modality was off on an individual basis. This was done because from case to case a lens may have been too steep, while another was too flat, thus making the average skew towards the zero point. The absolute values of each depth were taken to yield the following graph:
When looking solely at how far away from the final lens choice each modality was, the slide rule was closer, average absolute error of 18.2 microns, than the software, average absolute error of 23.45 microns.

Conclusions

Two Paragon CRT predicting modalities were judged by how close the overall sagittal depth compared to the successful CRT lens fit on 20 patients. While the slide rule yielded better results on average, the difference between it and the software was negligible when considering the difference was around 5 microns. Both modalities narrowed down the fitting set well enough for the practitioner to only have to make minor adjustments to achieve success fitting Paragon CRT.