Conference Papers

2021-06-24

What type of soft contact lens works best for reverse piggyback?

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Recommended Citation

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Final Year Research Project

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Introduction: Reverse Piggyback

- Reverse piggyback systems (RPS) comprise of a soft contact lens (SCL) worn over an RGP lens.

- Most commonly used to prevent the loss or decentration of an RGP lens during sports.

- Also used to reduce RGP lens intolerance due to lid sensitivity.

- RPS are seldom fitted and are mostly worn on a part time basis.

Objective

- The aim of this study was to determine which type of SCL works best for RPS based on:

    1. Best corrected visual acuity (BCVA)

    2. Comfort

    3. Power contribution

- The null hypothesis is that all SCLs work equally well in a RPS.
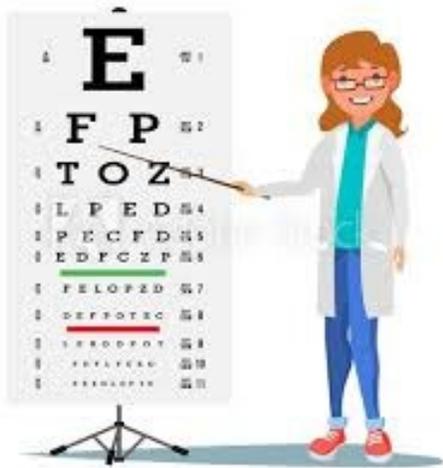
Methods

► A double-blind randomized trial was conducted.

► Four different types of SCL were assessed in a RPS, in both eyes of 12 subjects.

► For each subject, a researcher inserted an RGP lens into both eyes.

► Then 4 SCLs were inserted over and removed from the RGP lens consecutively.

► Over refraction (OR), BCVA and comfort were measured for each SCL in the RPS, then for the RGP lens alone.

Soft Lenses	Brand	BC	TD	Material
Acuvue Oasys 1 Day	Johnson & Johnson	8.5	14.3	Senofilcon A
Proclear 1 Day	Coopervision	8.7	14.2	Omafilcon A
1 Day Acuvue Moist	Johnson & Johnson	8.5	14.2	Etafilcon A
Dailies Total 1	Alcon	8.5	14.1	Delefilcon A

Table 1: *Details of soft contact lenses used.*

Methods

▶ All subjects were optometry undergraduates.

▶ The inclusion criterion was that they had to be able to tolerate SCL wear and RGP lens wear without anaesthetic. A BCVA of 0.5 LogMAR or better was necessary for data analysis.

▶ Comfort was measured using a 10cm visual analogue scale.

▶ BCVA was measured using a computerized LogMAR chart

▶ OR was measured using a manual phoropter.

▶ Results were analysed with respect to change from baseline measurements of RGP lens alone.
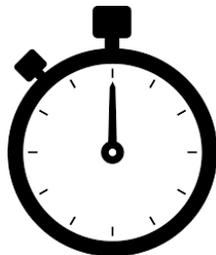
Results: Change in Over Refraction

- All SCLs had a power of -0.50D.

- The OR with the RGP lens alone was subtracted from the OR with the RPS in place.

- The data for etafilcon A was not normally distributed. However the frequency histogram for this SCL was relatively normal, so a one-way ANOVA test was used to analyse the data.

- One-way ANOVA testing showed **no statistically significant differences** at the $p<0.05$ significance level between the 4 SCLs for difference in OR **(p=0.91)**.
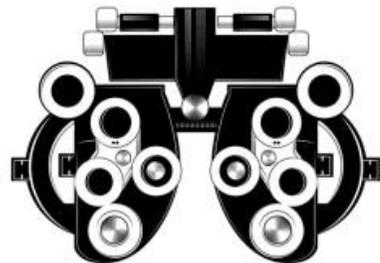
Results: Change in Over Refraction

▶ Changes in OR were not expected as it was assumed that low powered SCLs would not contribute power to the optics of a RPS.

▶ On average a small amount of plus was found.

▶ Normal test retest variation for refraction has been reported as ±0.50D, and may account for some changes in OR.

▶ Not all changes in OR can be explained by test-retest variation as a range of -0.75D to +1.25D existed.

	Senofilcon A	Omafilcon A	Etafilcon A	Delefilcon A
Mean	+0.25D	+0.17D	+0.16D	+0.21D
Standard Deviation	±0.40D	±0.45D	±0.47D	±0.45D
Range	-0.75 to+1.00D	-0.50 to +1.25D	-0.50 to +1.00D	-0.50 to +1.00D

Table 2: *Change in over refraction with each SCL.*

Results: Change in BCVA

- The BCVA with the RGP lens alone was subtracted from the BCVA with the RPS in place.

- One-way ANOVA testing could not be carried out as the data was not normally distributed and the frequency histogram did not resemble a normal distribution.

- Instead, a Kruskal-Wallis test was carried out, which showed **no statistically significant differences** at the $p < 0.05$ significance level between the 4 SCLs for BCVA **(p = 0.68)**.
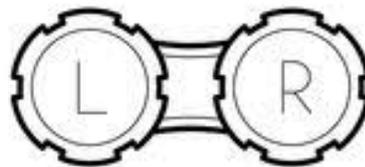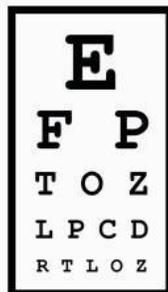
Results: Change in BCVA

▶ On average, all SCLs caused a loss of approximately half a line of LogMAR BCVA.

▶ The difference in BCVA ranged from a loss of 16 letters to a gain of 13 letters.

▶ Reductions in BCVA may be explained by an originally lid-attached RGP lens losing its lid attachment with the addition of a SCL.

▶ The loss of lid attachment may cause decentration of the RGP lens, reducing BCVA.

	Senofilcon A	Omafilcon A	Etafilcon A	Delefilcon A
Mean	-0.05 (loss of 2.5 letters)	-0.04 (loss of 2 letters)	-0.04 (loss of 2 letters)	-0.06 (loss of 3 letters)
Standard Deviation	±0.1	±0.09	±0.09	±0.1
Range	-0.18 to +0.24	-0.20 to +0.22	-0.32 to 0.16	-0.22 to +0.26

Table 3: *Change in BCVA with each SCL.*

Results: Comfort

▶ The difference in comfort between the RGP lens alone and the RPS was calculated and ranked for the 4 SCLs.

▶ According to research by Papas, a change in comfort of <5 units does not represent a true clinical difference.

▶ Friedman analysis showed **no statistical difference** at the p<0.05 significance level between the 4 SCLs for comfort **(p=0.15)**.

Results: Comfort

▶ The addition of a SCL demonstrated an increase in comfort for most subjects.

▶ Improvements in comfort may be due to the SCL reducing lid interaction with the RGP lens.

▶ Reduced comfort may have been caused by air bubbles under the SCL or due to the SCL being inside out.

	Senofilcon A	Omafilcon A	Etafilcon A	Delefilcon A
Mean	2.22	2.84	2.19	2.89
Standard Deviation	±1.0	±0.95	±1.01	±0.198

Table 4: *Change in comfort with each SCL.*

Conclusion

▶ **<u>No clinically significant differences</u>** were identified in the performance of the 4 SCL types in a RPS system.

▶ Our project suggests any of the 4 SCLs tested could be successfully used in a RPS.

▶ However, a SCL must be assessed in a RPS as it may cause reductions in comfort and BCVA, as well as changes to OR.

▶ The reductions in comfort and BCVA may be due to an originally lid-attached RGP lens losing its lid attachment with the addition of a SCL.

▶ The loss of lid attachment may cause decentration of the RGP lens and reduce the stability of the fit.

Limitations

▶ The sample size was not large enough to eliminate random variation.

▶ The subjects were not adapted RGP wearers and the RGPs were not all the optimum fit.

▶ SCLs were inserted simultaneously, rather than consecutively, which may have biased comfort grading.

▶ A longer settling time should have been given (>3mins) for the RGP lens alone and the RPS, particularly for assessment of comfort.

▶ A higher powered SCL would be required to fully ascertain the power contribution from a SCL in a RPS.

▶ Slit lamp examination of the RPS would have been useful to determine whether all the uncomfortable RPS and/or RPS that produced reduced BCVA were due to breaking RGP lid attachment.

▶ SLE would also allow inside-out lenses to be removed and reinserted the right way around.

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