

Intra- and Inter-Visit Repeatability of a Contemporary Profilometer

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Introduction

- Mapping corneoscleral topography is becoming increasingly important in successful scleral lens fittings
- Since scleral contact lenses are large in diameter and rest on the conjunctiva/sclera, it is important to understand ocular shape beyond the limbus in order to maximize its alignment with the lens’ landing zone (1, 2)
- Current instrumentation exists to map scleral shape such as the sMAP 3D, Pentacam tomographer, and the Eaglet Eye Profilometer (EEP)
- However, to the authors’ knowledge, the latter has not been validated to provide repeatable measurements in the past
- The purpose of this study is to determine intra- and inter-visit repeatability of measurements made with EEP

Materials and Methods

- Prospective, non-randomized control study
- Data was collected using the EEP at two different chords (D1=13mm, D2=15mm) (see Graph 1)
- Four different scans were taken per eye at 2 minute intervals each
- The last 3 measurements were merged together to generate a composite eye
- Only images with a quality of 100% were accepted
- Baseline assessment (V1) was repeated at a second visit (V2>72hrs from V1)
- The data extracted is noted in Table 1
- Statistical analysis:
 - Intra-visit repeatability: One-way repeated measures ANOVA
 - Inter-visit repeatability: A paired t-test, validated using the Wilcoxon test

Results

- Fourteen participants (5M, 9F, mean age 23.9±1.4 years) were enrolled and completed the study (28 eyes)
- Within the same visit → no statistically significant difference was found for all values
- There was no statistically significant difference when comparing the first measurement to the composite eye
- Therefore, the composite image was used to compare inter-visit repeatability at each chord
- Between V1 and V2, four measurements presented a statistically significant difference (see table 2)
- Post-hoc analysis revealed that none of these values were affected by gender (M vs F) or eye (OD vs OS)

Graph 1: Clinical Pathway

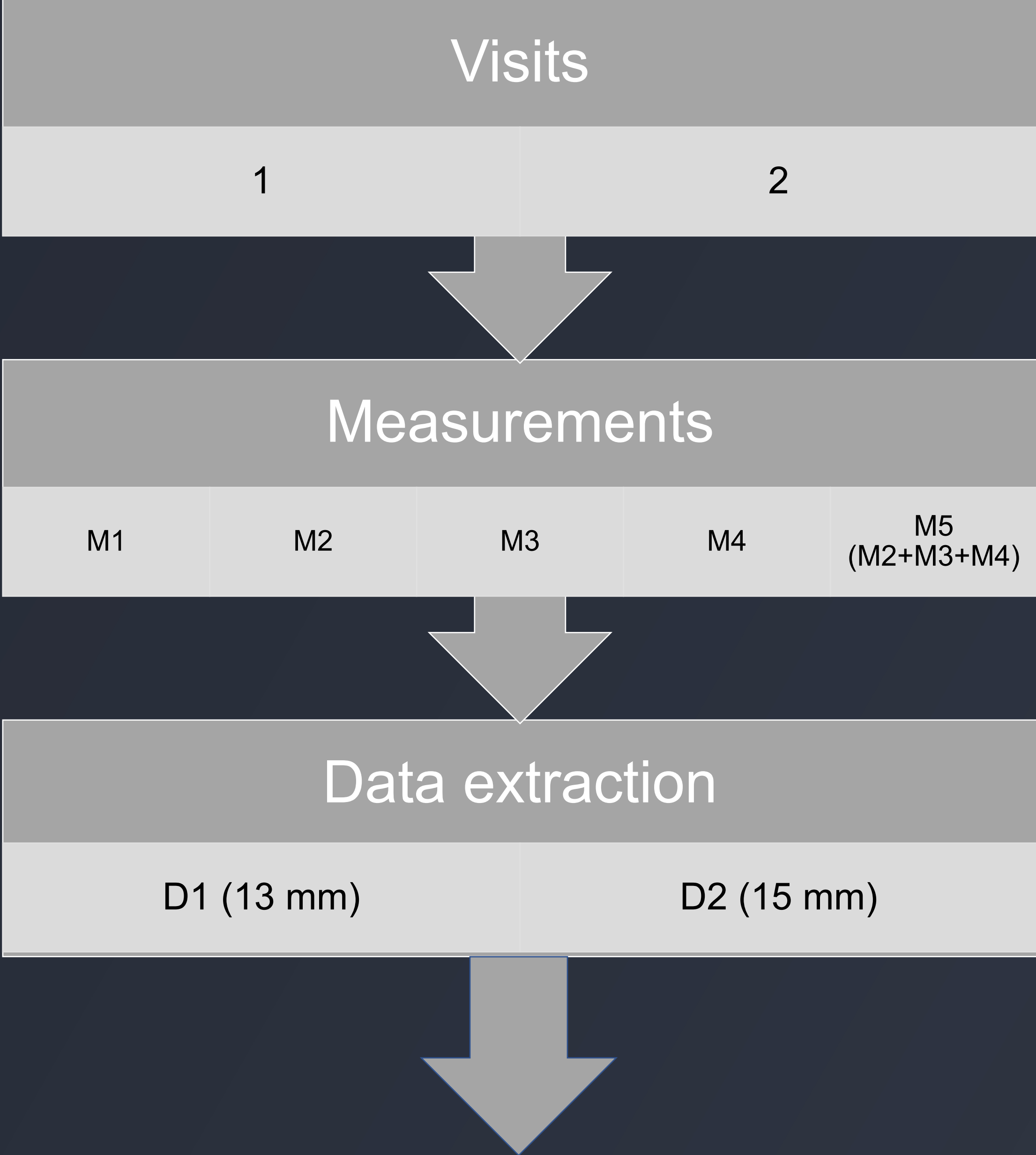


Table 1: Data extracted from measurements

Data	Unit	Abbreviation
Corneal astigmatism	Diopters (D)	AST
Axis of corneal astigmatism	Degrees (°)	AX
Average sagittal height over the full 360° of the eye	Millimeters (mm)	S360
Temporal sagittal height	Millimeters (mm)	TS
Nasal sagittal height	Millimeters (mm)	NS
Maximum sagittal height over the entire ocular surface	Millimeters (mm)	maxSAG
Axis of maxSAG	Degrees (°)	AxeMaxSAG
Minimum sagittal height over the entire ocular surface	Millimeters (mm)	minSAG
Axis of minSAG	Degrees (°)	AxeMinSAG

Table 2: Measurements showing a statistically significant difference between visit 1 and visit 2

Measurement	TS	NS	NS	minSAG
Chord (mm)	13	13	15	15
p-value from t-test	0.0005	<0.001	0.001	0.0224, signed rank 0.0166
SAG @ V1 (mm)	2.922±0.1713	2.744±0.1386	3.406±0.1791	3.442±0.1992
SAG @ V2 (mm)	2.871 ±0.1379	2.797±0.1351	3.488±0.1727	3.481±0.1848
Δ SAG (V1 – V2) (mm)	0.051	0.053	0.082	0.039

Discussion

- Although the four previous measurements present statistically significant differences, considering that the tear film is roughly 0.050 mm in thickness, these differences may not present a clinical impact on scleral lens fittings
- Clinically significant measurements from the EEP for scleral lens fittings are the average sagittal height value over the entire surface (S360) and the maximum and minimum SAG values to better understand conjunctival toricity
- While the minSAG showed a statistically significant inter-visit difference at 15mm, the value of this change between V1 and V2 is 0.039 mm, which is less than the thickness of the tear film as described above
- The amount of fluid instilled to take the measurement was not controlled in this study, which may also have biased the results and could further explain these differences

Conclusion

- The results of this study demonstrate that six of the nine common measurements generated by the EEP present repeatable results within the same visit and between visits
- Measurement of the most significant parameters for scleral lens fitting are highly repeatable over time.
- EEP profilometer is confirmed as a valid method to analyse corneoscleral shape of the eye
- Further studies are required to evaluate whether the measurements demonstrating a statistically significant difference between visits have a true clinical impact on lens fittings

References

1. Visser ES, Visser R, Van Lier HJ. Advantages of toric scleral lenses. Optom Vis Sci. 2006;83(4):233-6.
2. van der Worp E, Bornman D, Ferreira DL, Faria-Ribeiro M, Garcia-Porta N, Gonzalez-Mejome JM. Modern scleral contact lenses: A review. Cont Lens Anterior Eye. 2014;37(4):240-50.