

DIMENSIONAL STABILITY

OVER TIME OF THREE-DIMENSIONALLY
PRINTED IMPLANT SURGICAL GUIDES UNDER
DIFFERENT STORAGE CONDITIONS

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INTRODUCTION/Aim

The **accuracy** of guided implant placement relies heavily on the trueness and dimensional stability of 3D-printed surgical guides



Post-printing **factors** can induce polymer relaxation or continued curing, thereby altering surgical guide accuracy



Variability in surgical guide stability may result in **discrepancies** between planned and actual implant positions

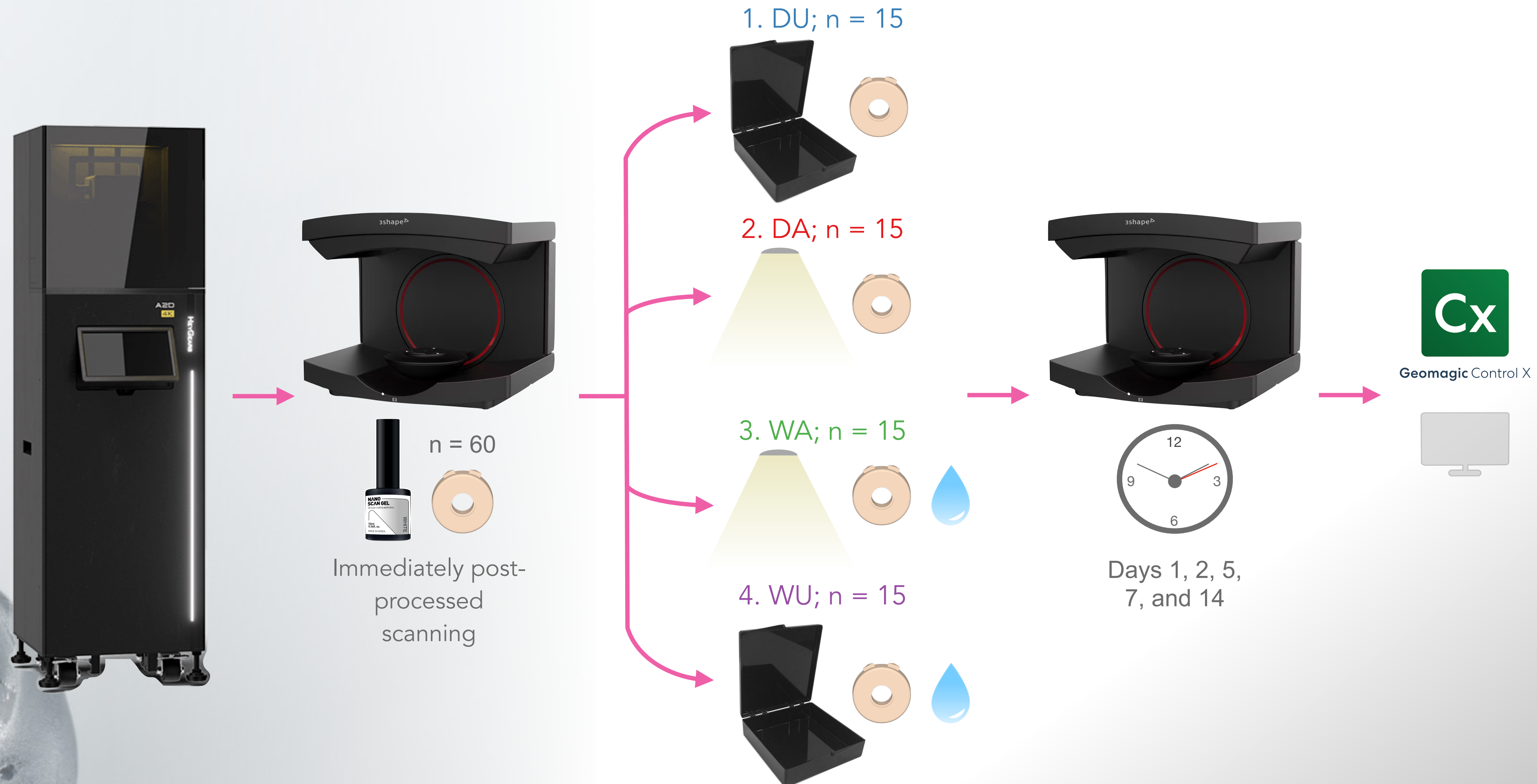
AIM: To understand how different storage conditions affect dimensional changes of surgical guide material in order to optimize clinical reliability

METHODS/StudyDesign

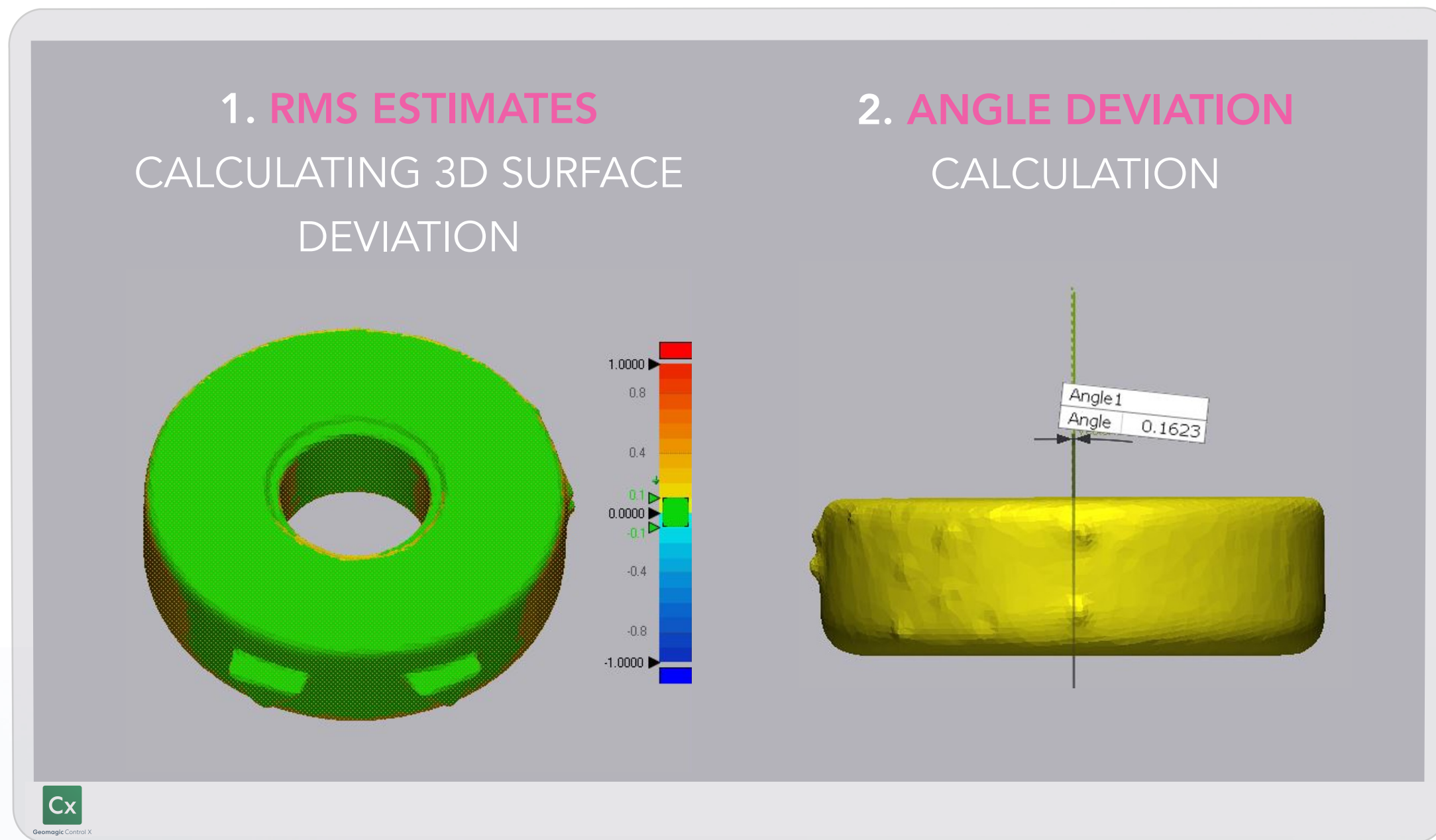
60 standardized surgical guide prototypes were printed using a **HeyGears A2D 4K printer** (DLP) and post-processed.

Samples were stored under 4 conditions (n = 15):

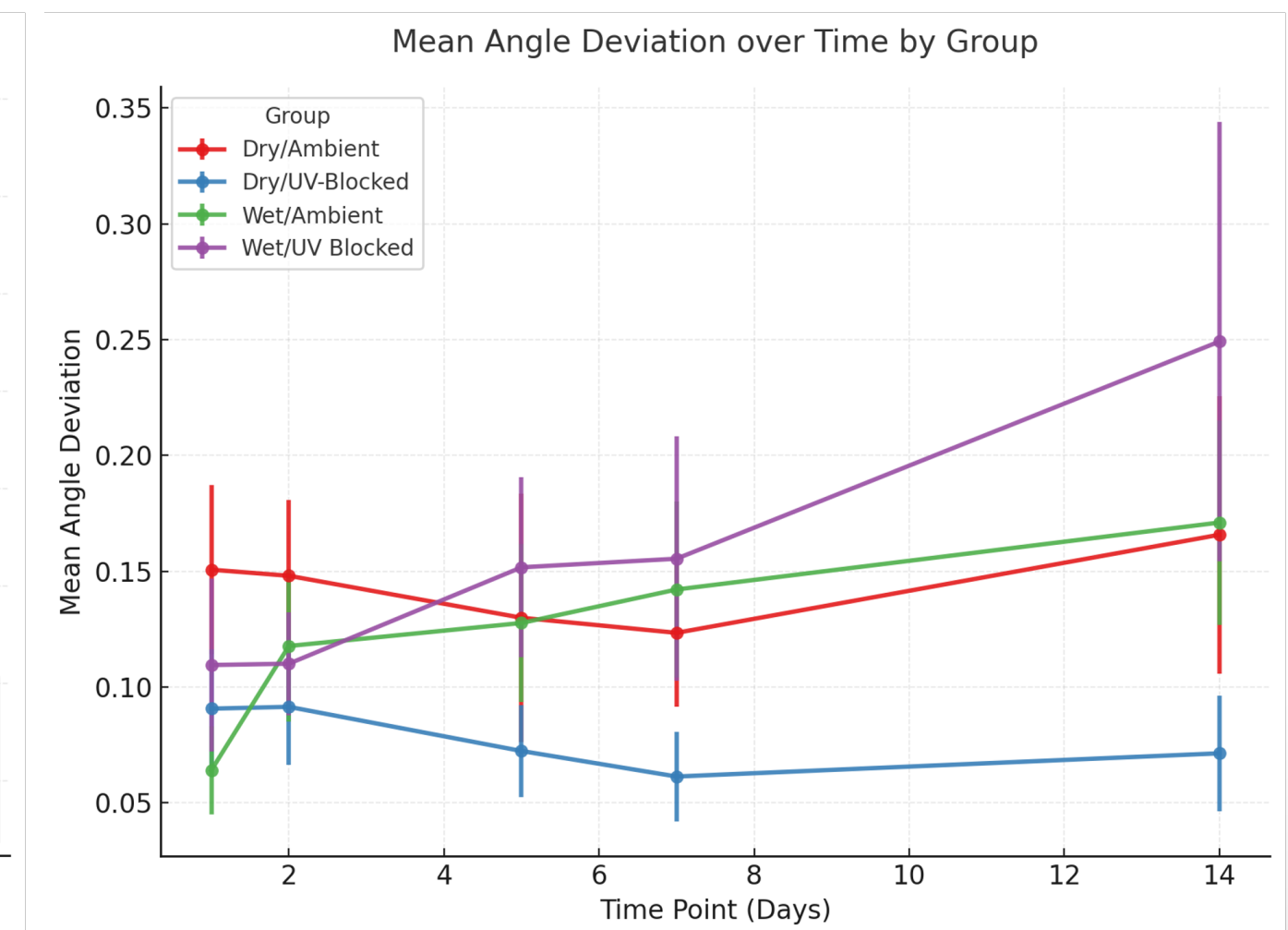
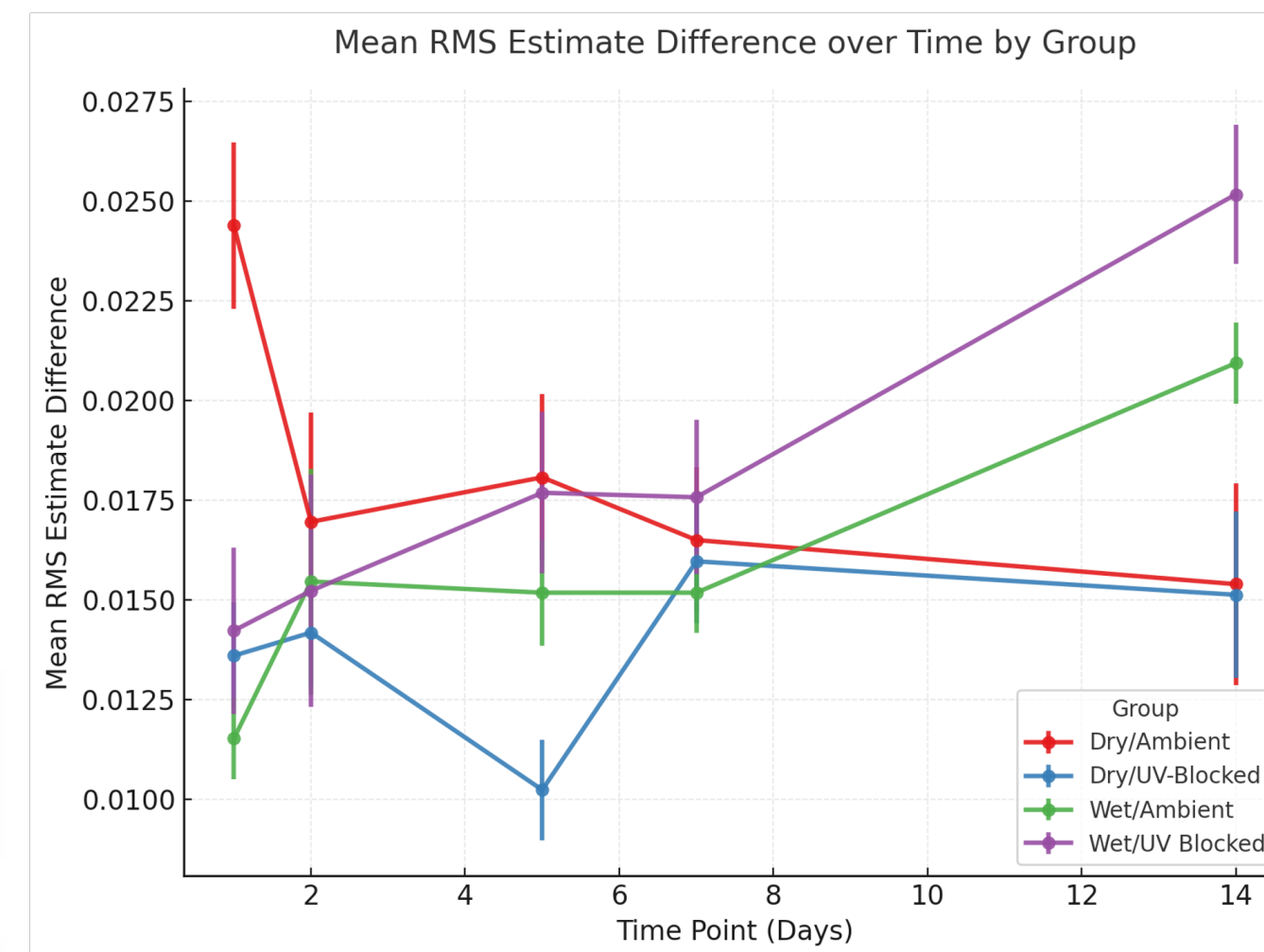
1. Dry/UV-Blocked (DU)
2. Dry/Ambient (DA)
3. Wet/Ambient (WA)
4. Wet/UV-Blocked (WU)



RESULTS



Statistics: Two-way repeated-measures ANOVA with Tukey HSD post-hoc tests ($\alpha = .05$) assessed effects of group and time.



RMS Estimate Difference: Significant effects for group ($F = 22.61$; $P < .001$), time ($F = 15.10$; $P < .001$), and interaction ($F = 18.55$; $P < .001$). The **Dry/UV-Blocked group** maintained the most stable RMS values throughout the 14 days.

Angle Deviation: Significant main effects of group ($F = 13.95$; $P < .001$) and time ($F = 5.54$; $P = .0003$), and a significant interaction ($F = 2.68$; $P = .002$). The **Dry/UV-Blocked group** consistently had the lowest deviation across all time points.

Trend: Stability decreased under wet and/or ambient light conditions, with Wet/UV-Blocked showing the greatest deviation over time.

CONCLUSIONS

Dimensional stability of 3D-printed surgical guides is **significantly** influenced by storage condition and elapsed time after post-processing.

1. Dry, UV-blocked storage demonstrated the lowest RMS estimates and angle deviations, maintaining superior accuracy over 14 days.
2. Wet and light-exposed conditions promoted progressive dimensional distortion.
3. Clinically, **dry, UV-blocked storage** is recommended for maintaining surgical guide accuracy before implant placement.

References:

