



Physico-Chemical and Mechanical Behavior of Interim Restoration Materials

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OBJECTIVES

Interim restorations have an essential role in prosthodontic treatment and oral rehabilitation procedures, and their long-term application would often be required. They are made from various materials through different techniques, hence, finding a material with optimal properties in this group is challenging. Therefore, the objective of this experimental study is:

To investigate and compare the physico-chemical and mechanical properties of interim restoration materials produced by 3-D printing, milling, and conventional techniques. The impact of aging on these properties was also investigated.

MATERIALS AND METHODS

- Argen PMMA Disc (milled; ARGEN, USA), GC Temp (3-D printed; GC Inc. Japan), Mazic D Temp (3D printed; VERICOM. Korea), and Integrity (conventional; Dentsply-Sirona, USA) were used to fabricate the specimens (N = 40/group) according to specifications for flexural strength (FS), Barcol Hardness (H), water sorption (WS), and solubility (S) tests.
- Samples were stored in 37°C ultra-pure water and tested after 24 hours (baseline; n = 20) and after one month of storage (aged; n = 20). The pH of the storage media was also monitored and recorded. Two-way and one-way ANOVA ($\alpha = 5\%$) and Tukey tests were used to analyze the data.

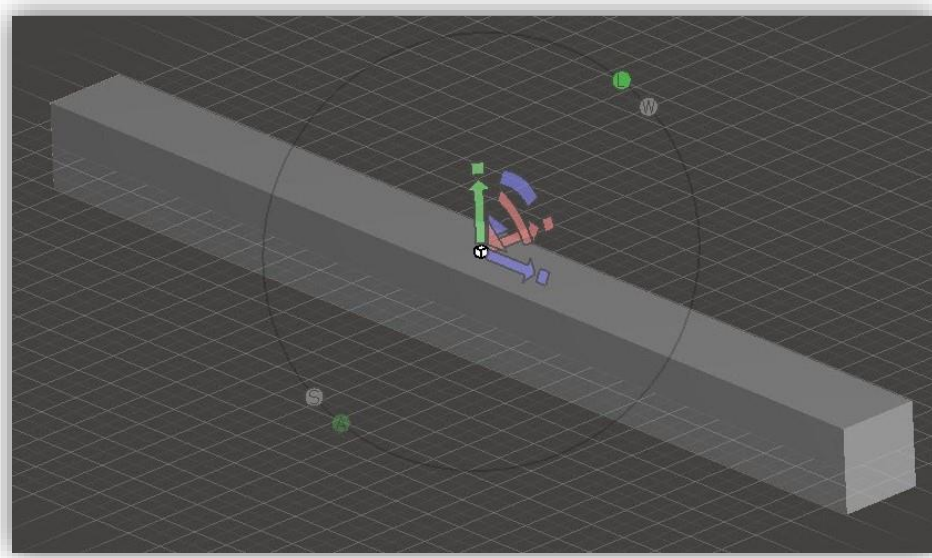


Figure 1: Computer assisted files of required shapes were created by Meshmixer design software and saved as a STL file.



Figure 3: Digital Barcol Hardness tester machine.



Figure 2: Specimens were prepared using a DLP printer, a 5-Axis open technology system milling machine, and Teflon molds.

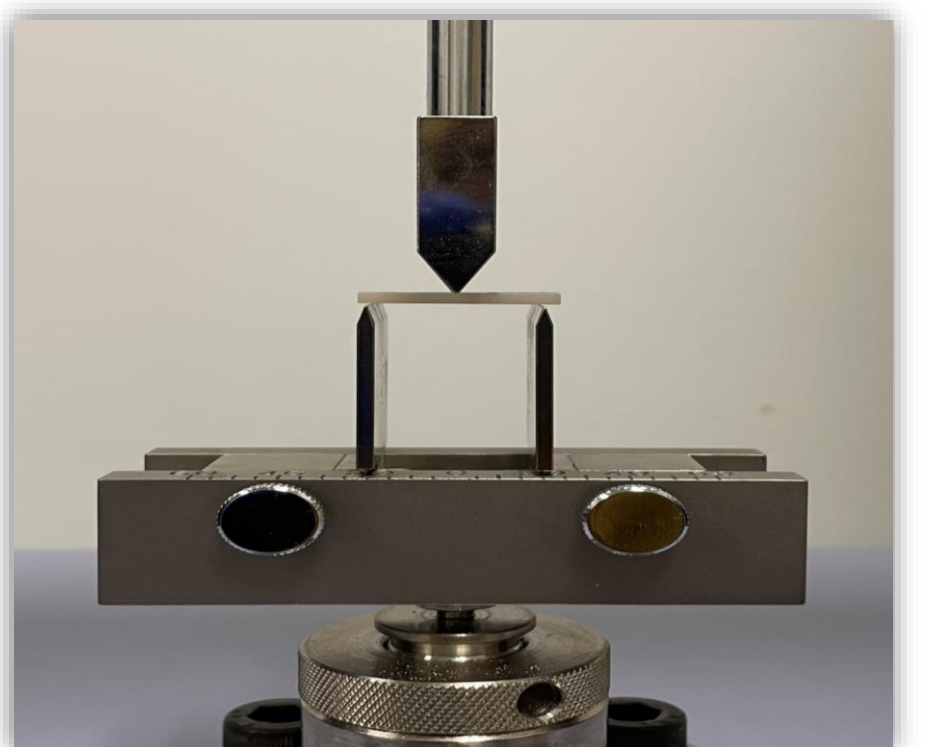


Figure 4: Flexural Strength Test.

RESULTS

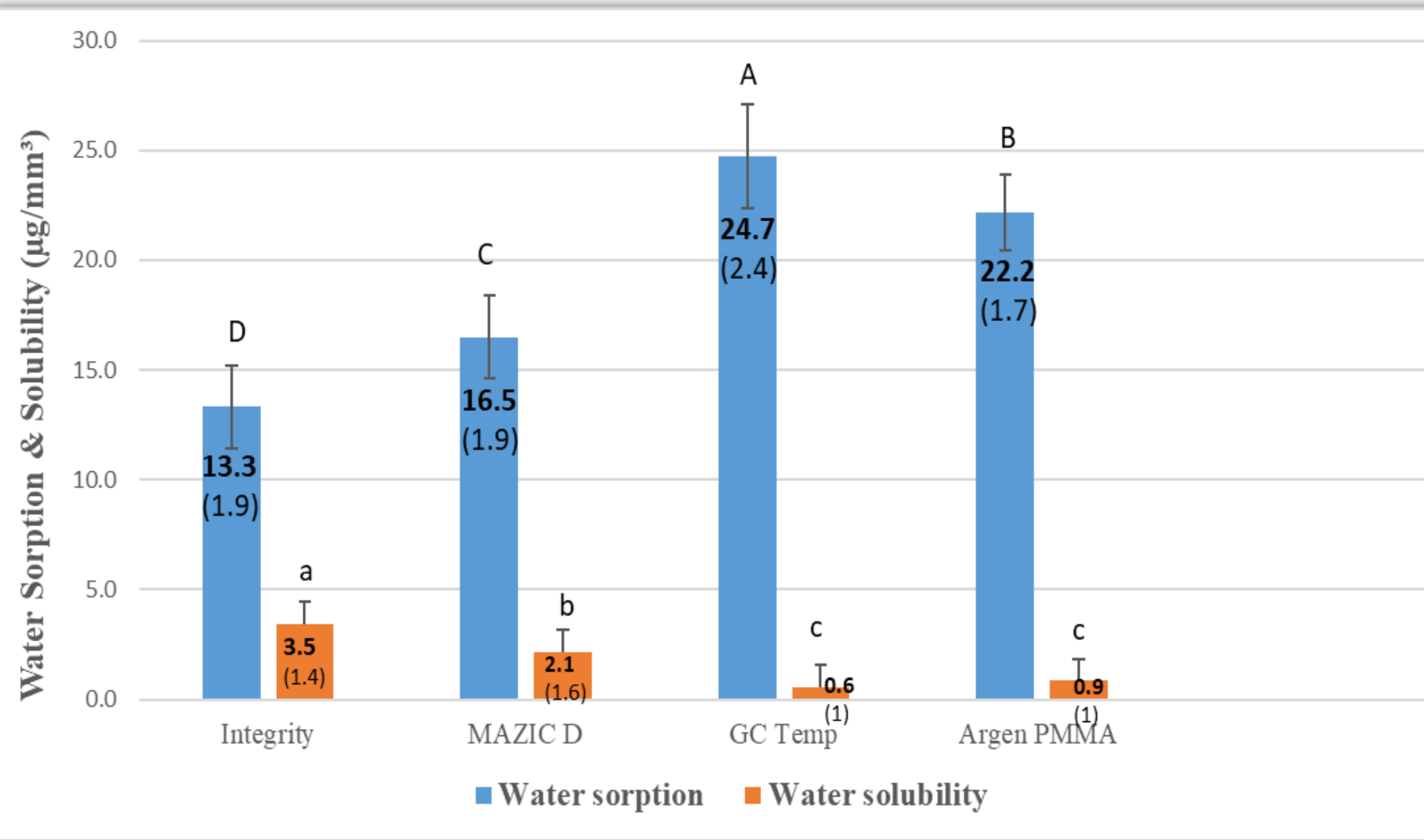


Figure 5: Water sorption and solubility of the four different selected materials. Different letters represent the statistically significant differences between the materials ($p < 0.05$, $n = 20$). The top number in each bar indicates the mean and the bottom one represents the standard deviation for each variable.

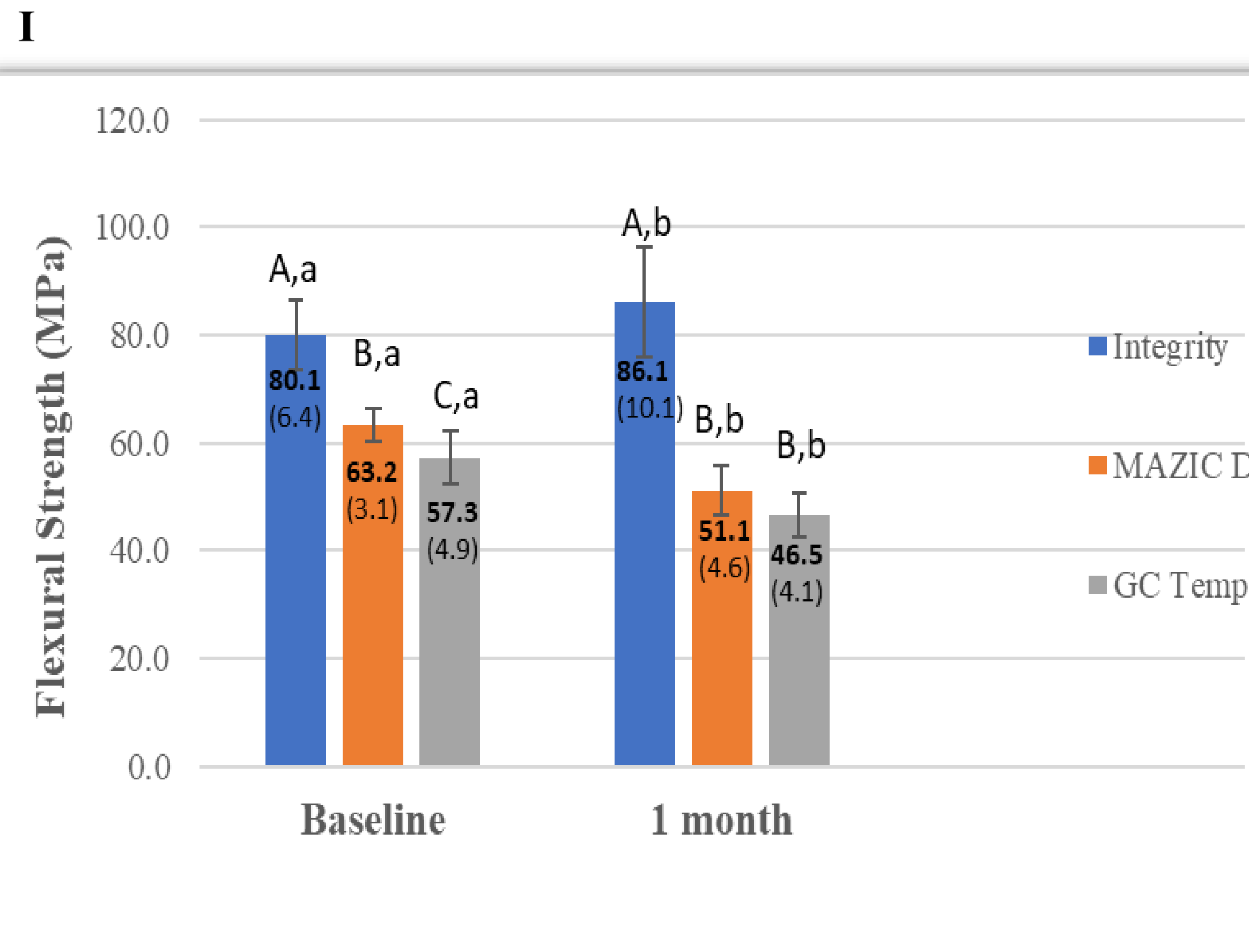


Figure 7: Flexural Strength (I) and Barcol Hardness (II) of the different materials at baseline and after 1-month of aging. Upper-case letters indicate statistically significant differences between the materials in each time-point and lower-case letters indicate statistically significant differences between the baseline and 1-month of aging for each group ($p < 0.05$; $n = 20$). Top and bottom numbers in each bar indicate the average and SD of the variable, respectively. Since the milled specimens did not break in the FS test, they are not included in graph I.

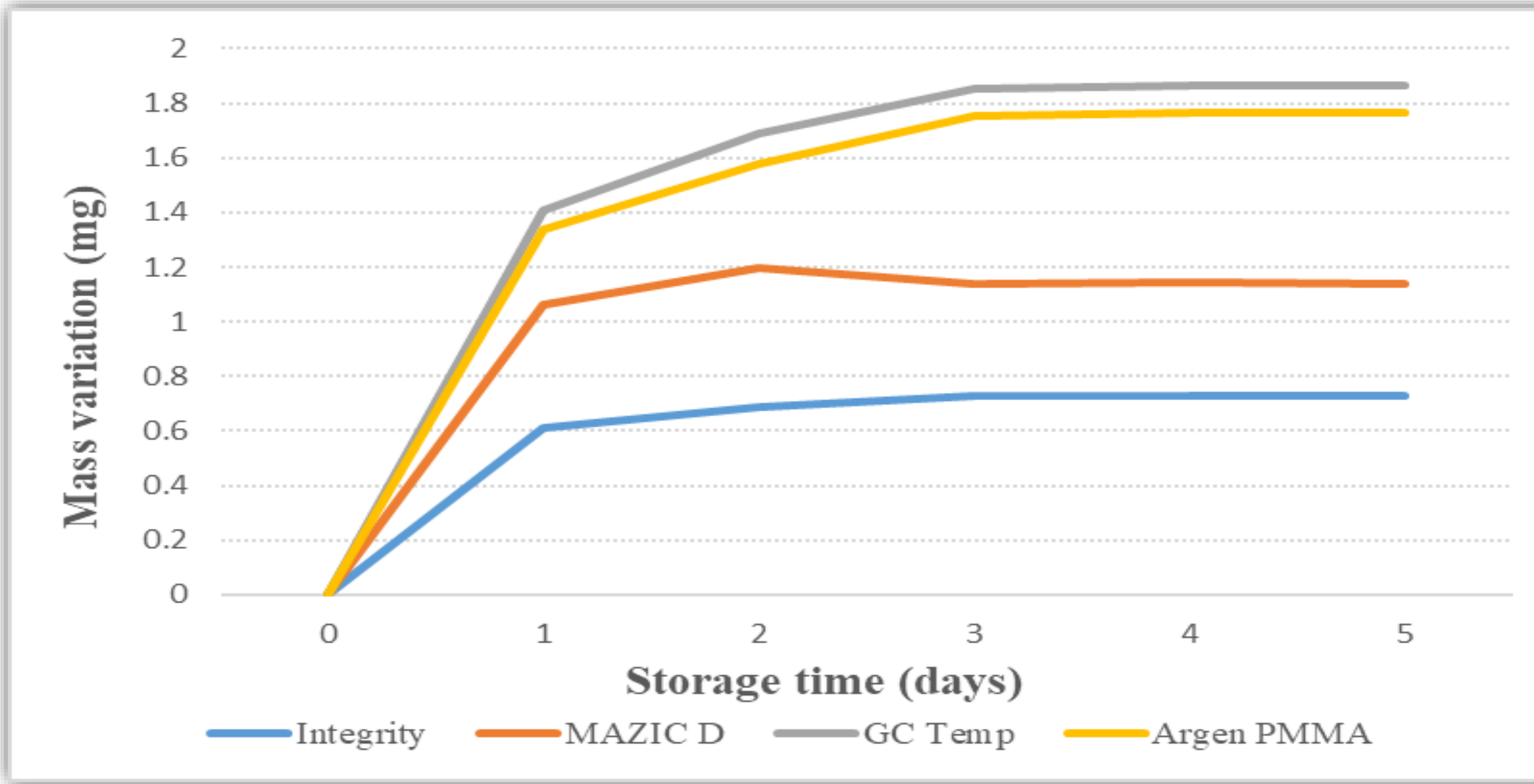
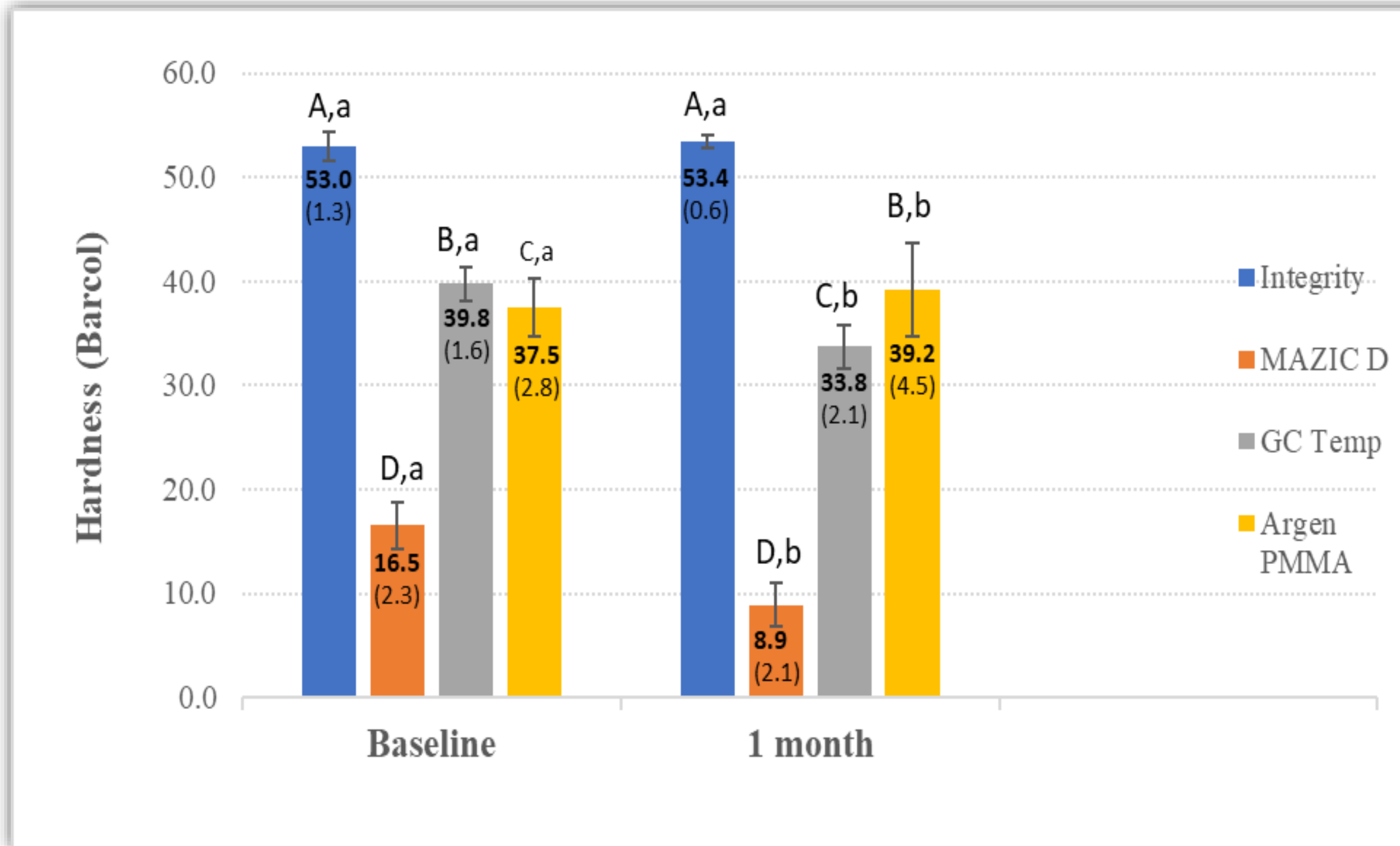


Figure 6: Changes in the mass of different interim materials over the 5-day water storage time ($n = 20$).

Table 1: Amount of PH change in all groups. The larger drop was measured in MAZIC D, followed by Integrity after 5 days.

MATERIAL	INTEGRITY	MAZIC D	GC TEMP	ARGEN DISC
PH CHANGE	-1.022	-1.23	-0.94	-0.96

II



CONCLUSIONS

- The physico-chemical and mechanical properties of the interim restorations are influenced by material type, method of fabrication, and water storage.
- Integrity, a bisacryl, conventional (two-paste mix) type of material, resulted in overall higher mechanical properties, with the exclusion of milled specimens in the FS test, and lower WS among the tested materials.
- Storage in water for one month resulted in different outcomes depending on the material, and reduced properties was not observed for all materials.
- Maximum mass change for all types of the materials was detected in the first 24 hours of the water storage period.

ACKNOWLEDGMENTS

Special Thanks to Dr. Maria Luísa Leite, and Maryam Samimi, for their contribution and cooperation.

RESOURCES

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