



Shade Reliability of IPS e.max ZirCAD Shade A1 with Varying Thickness: An In-Vitro Study

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INTRODUCTION

The use of zirconia for all-ceramic restorations has increased in recent years because of its strength and esthetics.^{1,2} More available translucency level and color options enabled clinicians to opt for zirconia when stronger mechanical property is a priority. However, shade reproduction of monolithic zirconia restorations has been shown to be affected during the laboratory production process.³ The factors that influence shade reproduction of dental zirconia include core thickness and translucency level.³ A study has demonstrated that dentists cannot deliver 65% of the finished prosthetic restorations during the first appointment because of tooth and prosthetic restoration shade discrepancies.^{4,5} Therefore, it is important to understand the shade reliability of zirconia.

OBJECTIVES

The aim of this study is to evaluate the shade reliability of IPS e.max ZirCAD MT (4 mol.% Y-TZP, Ivoclar Vivadent, Schaan Liechtenstein) in shade A1 with varying thicknesses.

METHODS

IPS e.max Shade Navigation App (ISNA) was used to select the recommended IPS e.max ZirCAD materials for a full crown option with VITA shade A1 and die shade ND3 (Figure 1). The ISNA recommended MT Multi A1. The discs were designed with varying thicknesses of 1.0 mm, 1.2 mm, 1.5 mm, and a diameter of 15mm (Figure 2). A total of 30 discs, 10 samples for each thickness, were milled and sintered according to the manufacturer’s instructions. The preset control (A1) in the spectrophotometer (VITA EasyShade, Yorba Linda, CA) was used as the control. The spectrophotometer (Figure 3) was calibrated following the manufacturer’s instructions from VITA EasyShade prior to testing in an operatory with no windows. A single measurement was performed for each disc by a single operator. Delta E (ΔE) values were recorded for each sample. ΔE represents the difference between two colors.⁶ The ΔE has three components: “L” represents lightness, “c” represents chroma, and “h” represents hue. The greater the ΔE value, the greater the difference between the discs’ shades and the control.⁷ The results were analyzed with descriptive statistics. Intergroup comparison was made using one-way ANOVA with post hoc Tukey parametric test. The ΔE values were also compared with the dentists’ perception of tooth color differences ($\Delta E = 3.3$) for clinical significance.⁶



Fig. 1 Each disc was placed on a die with shade ND3

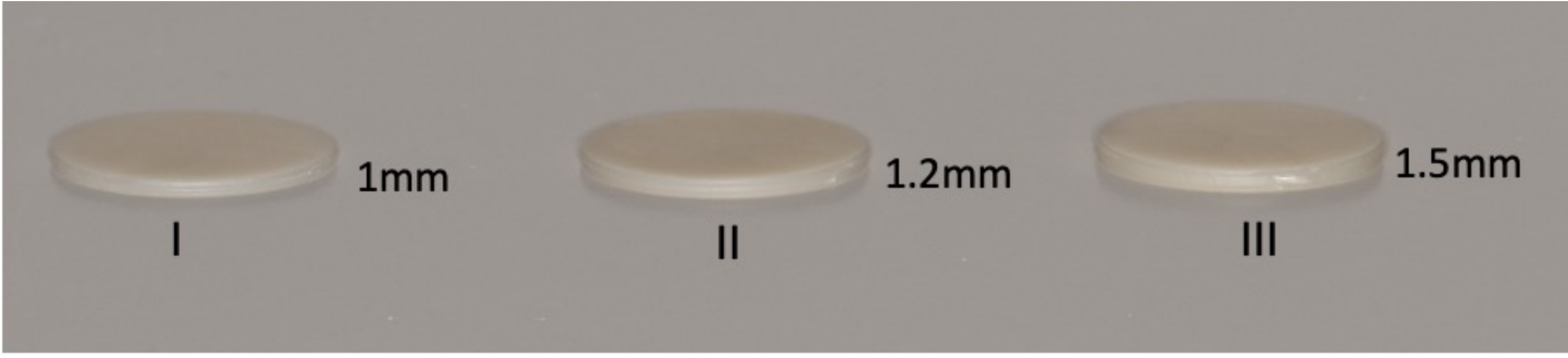


Fig. 2 Sintered IPS e.max ZirCAD discs with Group I. 1.0mm; Group II. 1.2mm; Group III. 1.5mm thickness. All discs share the same diameter of 15mm



Fig. 3 Vita EasyShade Spectrophotometer, Preset Control and ΔE measurements

Group	N	Range	Minimum	Maximum	Mean	Std. Deviation	P value
I	10	1.20	4.90	6.10	5.630	0.362	0.001**
II	10	2.00	3.90	5.90	4.780	0.646	
III	10	1.30	3.90	5.20	4.410	0.395	

Table 1. Descriptive Statistics of ΔE

** statistically significant $p < 0.05$

Dependent Variable	(I) group	(J) group	Mean Difference (I-J)	P value
GROUP	I	II	.8500	.002*
		III	1.220*	.000* *
	II	I	-.850*	.002*
		III	.370	.221
	III	I	-1.220*	.000* *
		II	-.370	.221

* & ** Statistically significant $p < 0.05$

Table 2. Mean Differences of ΔE

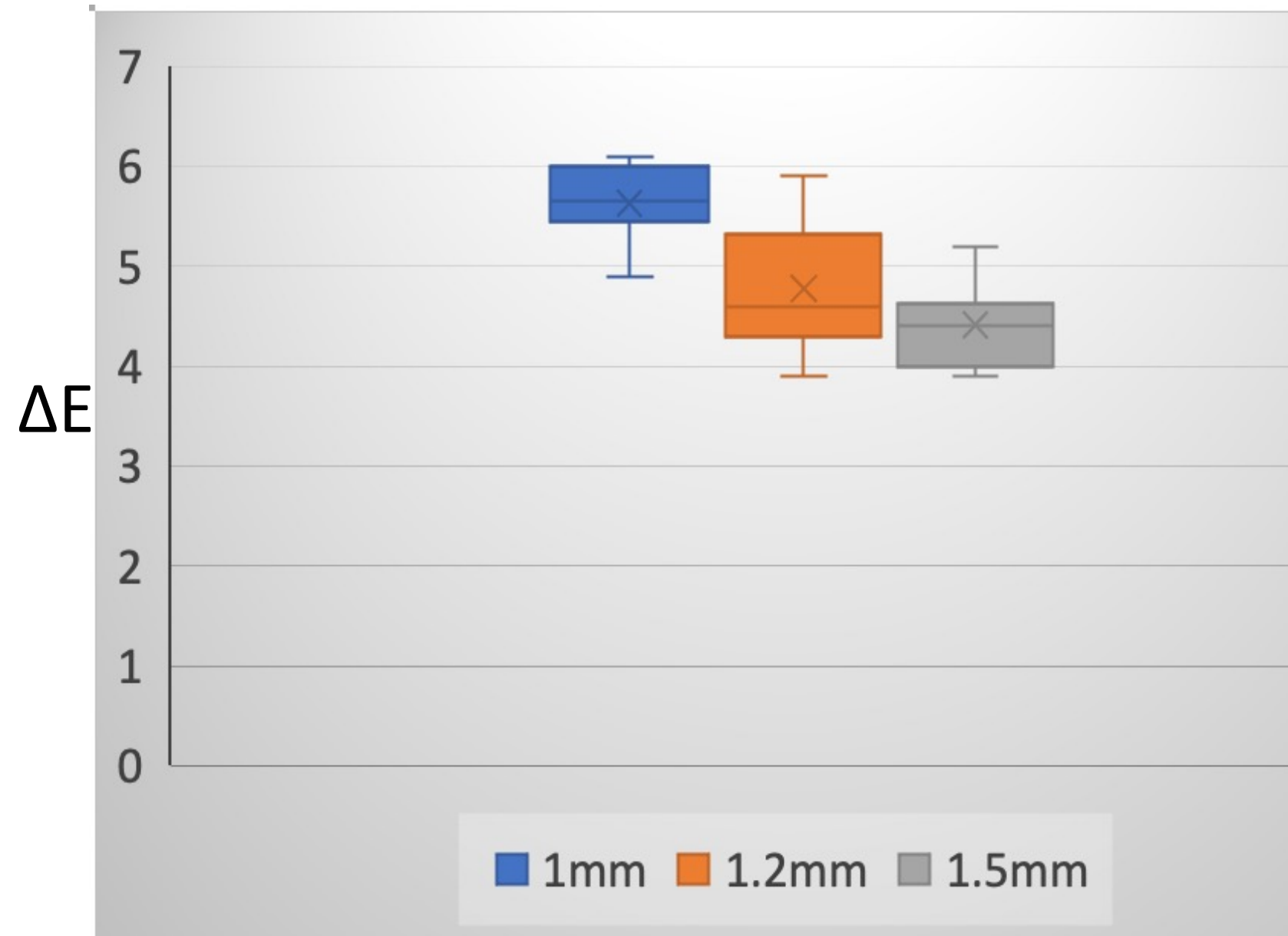


Fig. 4 Box Plot of Table 1

Samples/Ceramic Thickness in mm	1	2	3	4	5	6	7	8	9	0	% of $\Delta E > 3.3$
Group I	6.0	5.6	5.5	5.3	6.0	6.1	5.7	4.9	5.7	5.5	100%
Group II	4.6	5.3	4.0	5.4	4.4	4.6	5.2	5.9	3.9	4.5	100%
Group III	4.6	3.9	4.7	4.3	4.0	4.6	5.2	4.0	4.5	4.3	100%

Table 3. ΔE values of each disc in all three groups compared to dentists’ perception of tooth color differences ($\Delta E = 3.3$)

RESULTS

Descriptive statistics were used to compute the mean distribution of the parameters. The average ΔE values for the 1.0 mm, 1.2 mm, and 1.5 mm groups were 5.63, 4.78, and 4.41, respectively (Table 1 and Figure 4). The mean difference in ΔE between groups I and II ($p = 0.002$); and groups I and III ($p = 0.000$) were statistically significant (Table 2, $p < 0.05$). However, there was no statistical difference between groups II and III (Table 2, $p = 0.221$). The increase in material thickness decreased the mean difference in average ΔE value. Furthermore, the ΔE values from this study were analyzed against the threshold ΔE value of color change perceptibility of dentists ($\Delta E = 3.3$), which is shown in Table 3.⁶ 100% of the ΔE values in all groups were greater than ΔE of 3.3 (Table 3).

CONCLUSION

Within the limitation of this study, the 1.2mm and 1.5mm discs had higher shade reliability and are more likely to achieve clinically acceptable color match than the 1.0mm disc. This may help clinicians in deciding the material thickness in order to produce a predictable clinical outcome.

REFERENCES

