

Evaluation of Machinability of Feldspathic Blocks Using ISO 18675

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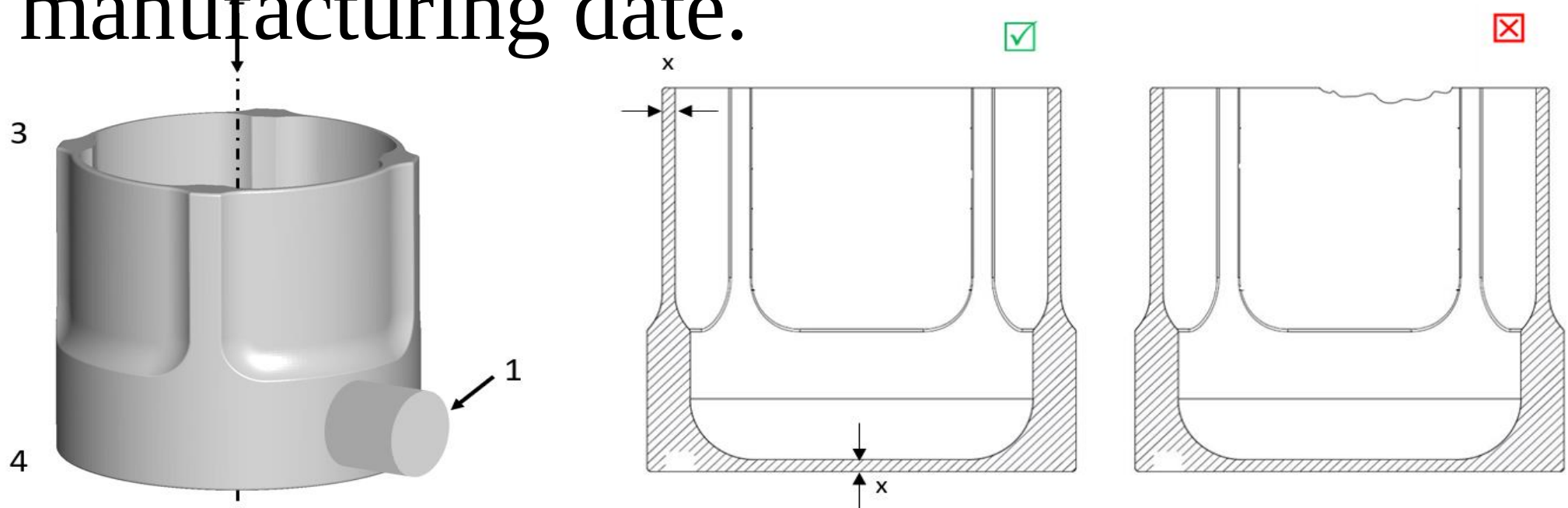
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Objective:

To evaluate the minimum required thickness for the success of milled ceramic restorations with a standardized method of preparation and milling procedure and to compare milling damage of Vitbloccs Mark II specimens fabricated using two milling units: Dentsply-Sirona CEREC Primemill and inLab MC X5.



Materials and Methods: Fifty (50) VITA Mark II CAD/CAM blocks (size of I-14 and shade 3M1C) were used to fabricate merlon specimens using Sirona inLab MCX5 and CEREC Primemill with specifications according to ISO 18675. Five specimens of each thickness of 0.1, 0.2, 0.3, 0.4, and 0.5 mm were prepared with each milling machine. For VITA Mark II, lot number was 95420 and a reference no. of EC43M1CI14 and of March 2023 manufacturing date.



The testing area on the left side is considered to be intact; the testing area on the right side is considered to be fractured as its top edge is broken

In CEREC Primemill, tools set were extra fine grinding diamond burs (white colored: sizes 1.0 CS, 0.6 CS, 1.4 CS, and 1.2 CS) with a normal speed were used. Milling parameters were inputted by the CAM software of CAD/CAM system. Wet milling was used.

Some burs were changed before the third block milling of group 0.4 mm thickness as the screen showed lower percentage level of function and they were as follows: bur 1.2 mm had remaining percentage of 66% and bur 1.4 mm had 76% of its 100%. There was another burs changing process before the milling of the fifth block of 0.1 mm thickness and they were: 1.2 mm bur with 55% remaining and 1.4 mm bur with 68% remaining



The burs used in MCX5 were diamond grinders or diamond coated grinders. Diamond grinders have a white color-coded size sequence of 0.6, 1.2, 1.4, and 2.2 mm, whereas all others have a yellow color-coded sequence of 0.5, 1.0, and 2.5 mm. After the milling preparation process in CEREC Primemill and inlab X5, the merlon walls and bottoms were measured for thickness. A merlon wall was considered failed if more than one third (1/3) of its top end was not complete seen by naked eye. The bottom was considered fractured if a hole can be visually observed.



Measurements were taken using a Mitutoyo caliper (0.02 mm tolerance) for wall thickness and micrometer (0.001 mm tolerance) for bottom thickness.

Results: The minimal machine thickness (with a 100% success rate) for the Merlon wall is 0.2 mm for MCX5 and 0.4 mm for Primemill. The minimal machine thickness (with a 100% success rate) for the bottom is 0.5 mm for MCX5 and 0.2 mm for PrimeMill milling machines.

Bottom and Wall Thickness Success Rate in MC X5 versus Primemill

Ideal Bottom Thickness (mm)	Avg Actual Bottom Thickness Primemill (mm)	Avg Actual Bottom Thickness X5 (mm)	Bottom Success Rate Primemill (%)	Bottom Success Rate X5 (%)
0.1	0	0	0	0
0.2	0.126	0.335	100	20
0.3	0.475	0.475	100	20
0.4	0.559	0.559	100	40
0.5	0.661	0.661	100	100

Ideal Merlon Thickness (mm)	Avg Actual Merlon Thickness Primemill (mm)	Avg Actual Merlon Thickness X5 (mm)	Merlon Success Rate Primemill (%)	Merlon Success Rate X5 (%)
0.1	0	0.168	0	0
0.2	0	0.243	0	100
0.3	0.17	0.315	70	100
0.4	0.305	0.427	100	100
0.5	0.394	0.525	100	100



Conclusion:

MCX5 has less edge chipping damage than the Primemill milling machine.

References:

JeongCS, et al., Evaluation of the machinability and machining accuracy of dental CAD/CAM wax blocks using merlon fracture test model, Dent Mater J, 2023;42(2):273-281

ISO standard 18675, Machinability of Ceramic Blanks, the VTA (vulnerable testing area) Test. International Organization for Standardization, 2022