The precision of fit of milled titanium implant frameworks (I-Bridge®) in the edentulous jaw

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Background

Titanium frameworks fabricated with a Computer Numeric Controlled (CNC) milling technique (Procera® implant Bridge (PIB), Nobel Biocare AB, Göteborg, Sweden) has been proven to have a fit superior to conventionally cast frameworks. With the recently introduced I-Bridge® (Biomain AB, Helsingborg, Sweden) an alternative CNC-milled framework is available.

Purpose

To evaluate the fit of I-Bridge® CNC-milled titanium frameworks using two different implant systems.

Material and Method

Two master models; one for Brånemark system® implants (Nobel Biocare AB) with external abutment connection (**Fig.1**) and one for NobelReplace™ implant system (Nobel Biocare AB) with internal abutment connection were fabricated together with ten individual acrylic resin patterns each (**Fig. 2**). Theses patterns were used in order to fabricate ten Titanium frameworks for each master cast in a CNC milling-machine.

Five additional Brånemark system® models with frameworks produced in routine production were used as "clinical controls". A Coordinate Measuring Machine (**Fig. 3**) was used to measure the center point positions of all implant replicas and framework fit surfaces (**Fig.4**). Distortion between frameworks and master models was analyzed by the "least square method".

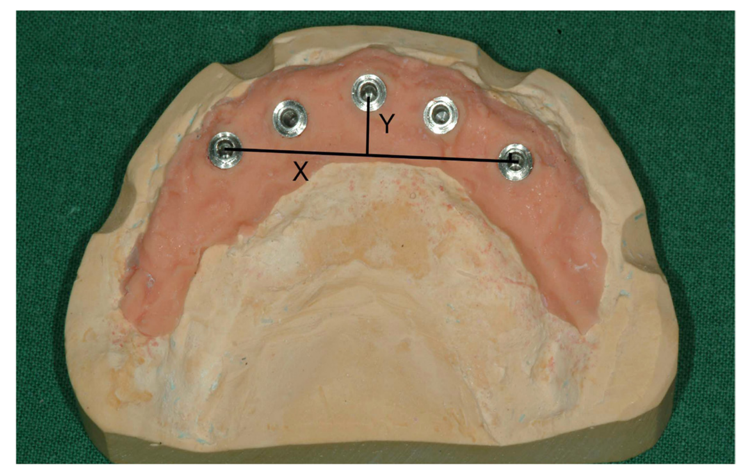

Fig.1 One master model illustrating "arch width" (X-axis) and "arch curvature" (Y-axis)

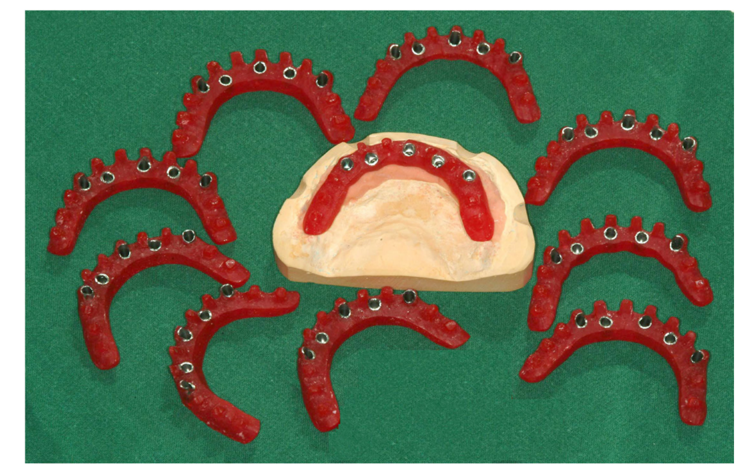

Fig.2 One master model and ten individual acrylic resin patterns

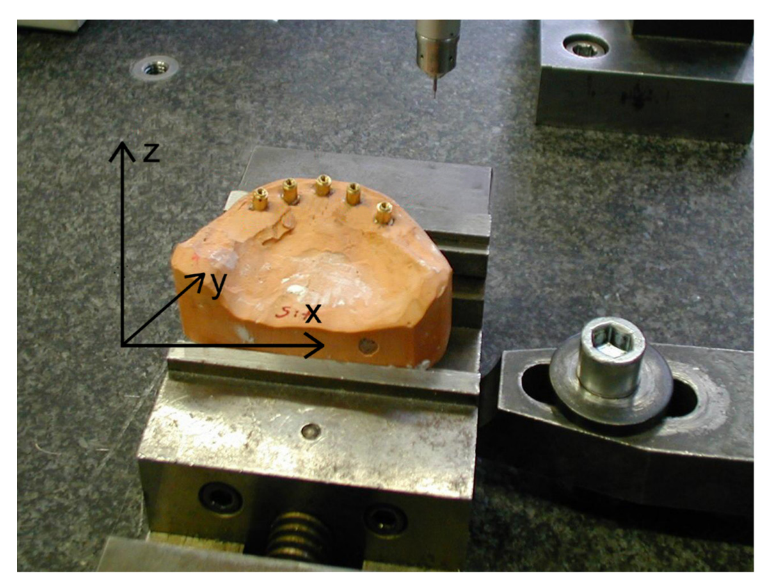

Fig.3 Set up of Coordinate Measuring Machine (CMM)

Fig.4 Centre point of seating surfaces of frameworks and implant analogs in master model

Table 1. Mean difference and standard deviation (SD) in arch width (x-axis) and arch curvature (y-axis) for test and control frameworks as compared to master models in microns (μm)

Group of frameworks/ mastermodels	Difference in arch width				Difference in arch curvature			
	Mean	(SD)	Min	Max	Mean	(SD)	Min	Max
NobelReplace™ (n=10/1)	23	(24)	-16	65	-3	(20)	-26	31
Brånemark system® (n=10/1)	-8	(6)	-19	-1	-22	(4)	-29	-16
Clinical control (n=5/5)	47	(15)	35	71	31	(18)	5	55

Results

Frameworks for the Brånemark system® implants presented a small, reduction of arch width (-axis) and arch curvature (y-axis).

Clinical control frameworks presented a small increase in both arch width and arch curvature.

Frameworks for NobelReplace™ implants presented a small increase in arch width but no significant difference in arch curvature (**Table 1**).

The mean distortion in absolute figures in x-, y-, z- axis and 3-D were significantly larger for clinical control frameworks as compared to Brånemark system® and NobelReplace™ frameworks (**Fig. 5**).

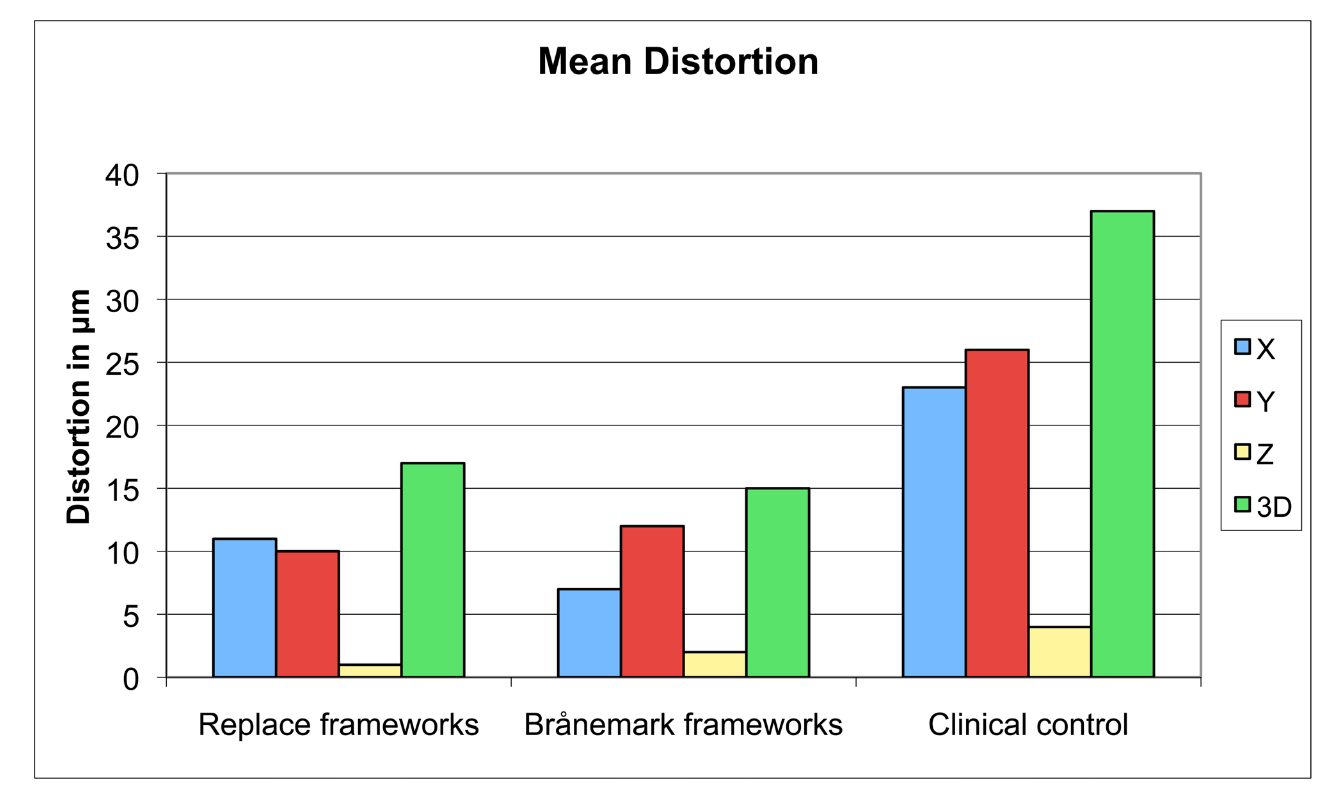

Fig.5 Mean distortion (in absolute figures) in μm of the center point of the frameworks presented with the master model as reference for the different framework groups.

Conclusion

Mean distortion for all frameworks was larger in the horizontal plane (x- and y-axis) with only small distortions in the vertical direction (z-axis).

Frameworks fabricated in a laboratory set-up tend to show less distortion as compared to similar frameworks fabricated on a more routine basis (clinical control).

Fit of frameworks were similar for the two implant systems used with no framework presenting a "passive fit" to the model.

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