VITA ENAMIC®

Recommodation for CNC machines

Machining mode : Grinding – Block & Disc

- Information and tips
- Tools
- Machining strategy
- Parameters

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Information

The information presented here, are intended as a recommendation.
Depending on the available CNC machines, CAM software, tools, etc. the information have to be adapted to your own production situation.
As a result, different results may obtained.

The development of the strategies and parameter was done with following system:

- imes-icore CORiTEC350i
- CAM Software: Hyperdent 8.2 Beta

According to this recommendation, a fully anatomical posterior tooth crown (tooth 26) can be finished in 19min (EM14 Block oder 12mm Disc), with a good surface and fit.

We recommend Tools from:

FRANKEN GmbH & Co. KG, Fabrik für Präzisionswerkzeuge
Tools for the Dental Industry
www.franken-dental.com

or

imes-icore® GmbH
www.imes-icore.de

Tips for VITA ENAMIC®

Avoid vertically or fast plunge movements. It is important that the tool always plunge slow and soft into the material.

- We recommend to grind VITA ENAMIC wet
- Plunge into the material with a ramp or helically (5 degree) and use a reduced plunge feed (feed Z)
- The diameter of the restoration holding pins should be 1,0-1,5 mm (2-3 pins per Restauration)
- If there is just one holding pin than the diameter should be 2,0 – 2,5 mm

Strategy

- A two side machining and 3+2 strategies are sufficient in most cases.
- In order to maintain a good fit, even by restoration with undercuts, the last finishing of the cavity should be done with a 5 axis strategy.
- In order to maintain a good occlusal fit, the complete occlusal side should be finished with max. a ø1.2mm tool (or less). In that way, a special finishing of the fissures isn`t necessary.
- If a smaller tool is used after a bigger one, it can be necessary to use a roughing strategy to remove remaining material.
  Tool life and process reliability are increased this way.
- To process cavities or pockets, the tool should be tilted 4-6 degrees (5 axis strategy). This will decrease the wear of the tool tip.
- When using grinding tools, the whole grinding body should be used.

Recommended Tools

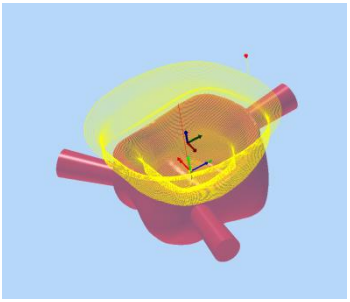
Diameter	Grain size	Description	Manufacturer	Order-Code	Max. Blank Depth
Ø 2 mm	D126	Diamond ball nose grinding burr	Franken	1716.200611 (6mm shaft)	12mm
Ø 1 mm	D76	Diamond ball nose grinding burr	Franken	1716.100609 (6mm shaft)	
Ø 2.5 mm	-	Diamond ball nose grinding burr	imes-icore	T21 (3 & 6mm shaft)	18mm
Ø 1 mm	-	Diamond ball nose grinding burr	imes-icore	T22 (3 & 6mm shaft)	

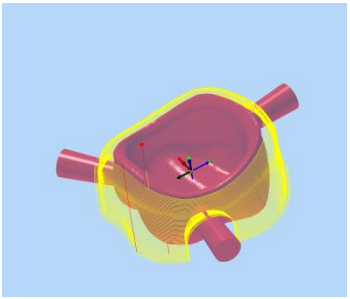
Tool Life

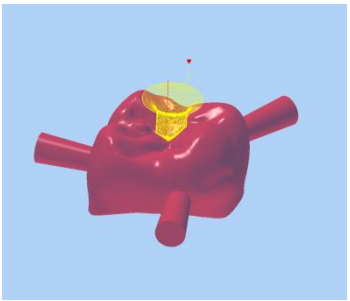
Tool	Units	Restoration
Ø 2 mm Diamond ball nose grinding burr	68 Stück	Fully anatomical crown tooth 26
Ø 1 mm Diamond ball nose grinding burr	>150 Stück	Fully anatomical crown tooth 26
Ø 2.5 mm Diamond ball nose grinding burr	>150 Stück	Fully anatomical crown tooth 26
Ø 1 mm Diamond ball nose grinding burr	>150 Stück	Fully anatomical crown tooth 26

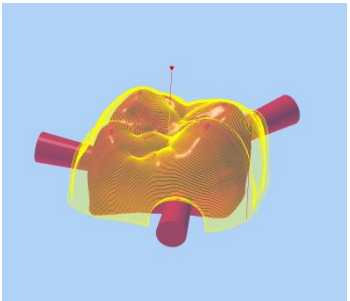
Order of Machining

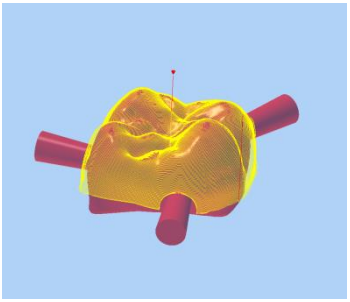
Step	Machining side	Machining	Tool
1	Cavity	Roughing	Ø 2.0 or Ø 2.5 mm
2	Cavity, outside	Roughing / Finishing	Ø 2.0 or Ø 2.5 mm
3	Occlusal side	Pre-Drilling	Ø 2.0 or Ø 2.5 mm
4	Occlusal side	Pre-Finishing	Ø 2.0 or Ø 2.5 mm
5	Occlusal side	Finishing /Fissures	Ø 1 mm
6	Preperation margin	Finishing	Ø 1 mm
7	Cavity	Finishing	Ø 1 mm
8	Cavity	Remaining material	Ø 1 mm

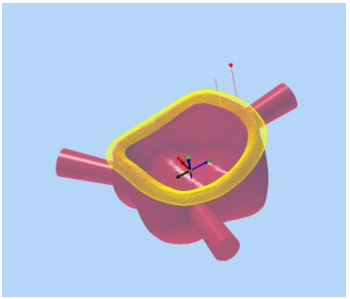
Step 1	Cavity - Roughing			3+2 axis
	Tool	Ø 2.0 or Ø 2.5 mm		
	Tolerance	0.01		
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	1500	mm/min
	Feed speed Z	[Vf]	500	mm/min
	Width of cut XY	[ae]	0.12	mm
	Depth of cut Z	[ap]	Full Tool	mm
	Oversize		0,05	mm

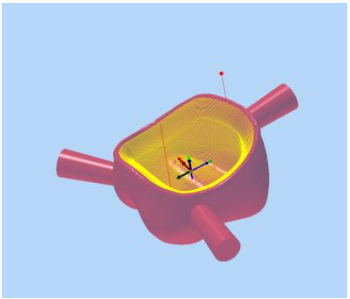
Step 2	Outside Cavity - Roughing / Finishing			3+2 axis
	Tool	Ø 2.0 or Ø 2.5 mm		
	Tolerance	0.01		
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	1500	mm/min
	Feed speed Z	[Vf]	500	mm/min
	Width of cut XY	[ae]	0.12	mm
	Depth of cut Z	[ap]	Full Tool	mm
	Oversize		0	mm

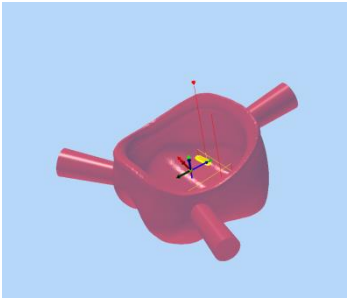
Step 3	Occlusal side - Pre-Drilling			3+2 axis
	Tool	Ø 2.0 or Ø 2.5 mm		
	Tolerance	0.01		
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	800	mm/min
	Feed speed Z	[Vf]	500	mm/min
	Width of cut XY	[ae]	0.1	mm
	Depth of cut Z	[ap]	Full Tool	mm
	Oversize		0	mm

Step 4	Occlusal side - Pre-Finishing			3+2 axis
	Tool	Ø 2.0 or Ø 2.5 mm		
	Tolerance	0.01		
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	1200	mm/min
	Feed speed Z	[Vf]	1000	mm/min
	Width of cut XY	[ae]	0.12	mm
	Depth of cut Z	[ap]	-	mm
	Oversize		0	mm

Step 5	Occlusal side - Finishing / Fissures			3+2 axis
	Tool	Ø 1mm		
	Tolerance		0.01	
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	1200	mm/min
	Feed speed Z	[Vf]	1000	mm/min
	Width of cut XY	[ae]	0.1	mm
	Depth of cut Z	[ap]	-	mm
	Oversize		0	mm

Step 6	Preperation Margin - Finishing			5 axis
	Tool	Ø 1mm		
	Tolerance		0.01	
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	1200	mm/min
	Feed speed Z	[Vf]	1000	mm/min
	Width of cut XY	[ae]	0,1	mm
	Depth of cut Z	[ap]	-	mm
	Oversize		0	mm

Step 7	Cavity - Finishing			5 axis
	Tool	Ø 1mm		
	Tolerance		0.01	
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	1200	mm/min
	Feed speed Z	[Vf]	1000	mm/min
	Width of cut XY	[ae]	0,1	mm
	Depth of cut Z	[ap]	-	mm
	Oversize		0	mm

Step 8	Cavity - Remaining Material			5 axis
	Tool	Ø 1mm		
	Tolerance		0.01	
	Spindel speed	[n]	40000	rpm
	Feed speed XY	[Vf]	1000	mm/min
	Feed speed Z	[Vf]	500	mm/min
	Width of cut XY	[ae]	0.1	mm
	Depth of cut Z	[ap]	0.05	mm
	Oversize		0	mm

Formulas for cutting data calculation

Expression used in text	Term	Symbol	Formula
Feed speed XY *Feed speed* Z	*Feed speed*	Vf [mm/min]	$Vf = fz * z * n$
Spindle speed	*Spindle speed*	n [rpm]	$n = \frac{Vc * 1000}{\pi * d}$
Width of cut XY	*Width of cut*	ae [mm]	
Depth of cut Z	*Depth of cut*	ap [mm]	
	Feed per cutting edge	fz [mm]	$fz = \frac{Vf}{n * z}$
	Cutting speed	Vc [m/min]	$Vc = \frac{\pi * d * n}{1000}$

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