

Thommen Medical Analog for CAD/CAM Root Cause Analysis

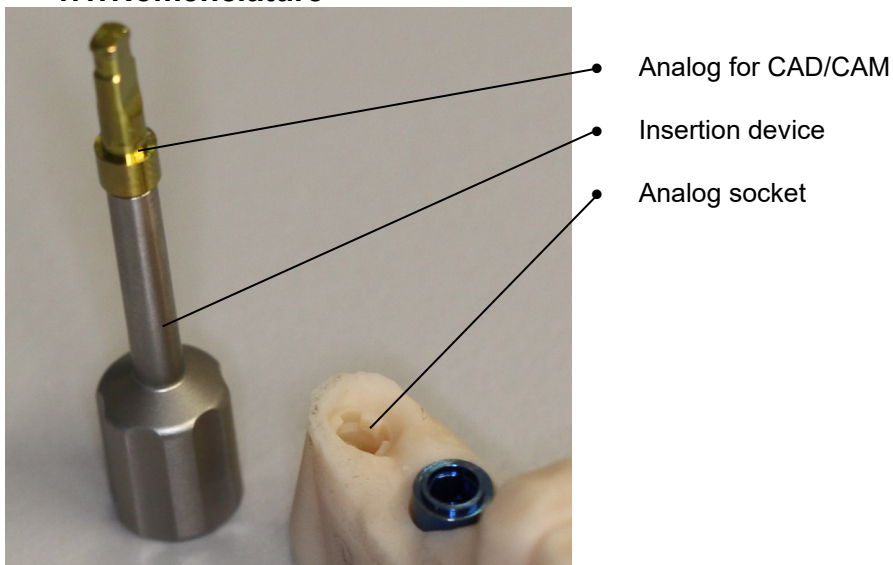
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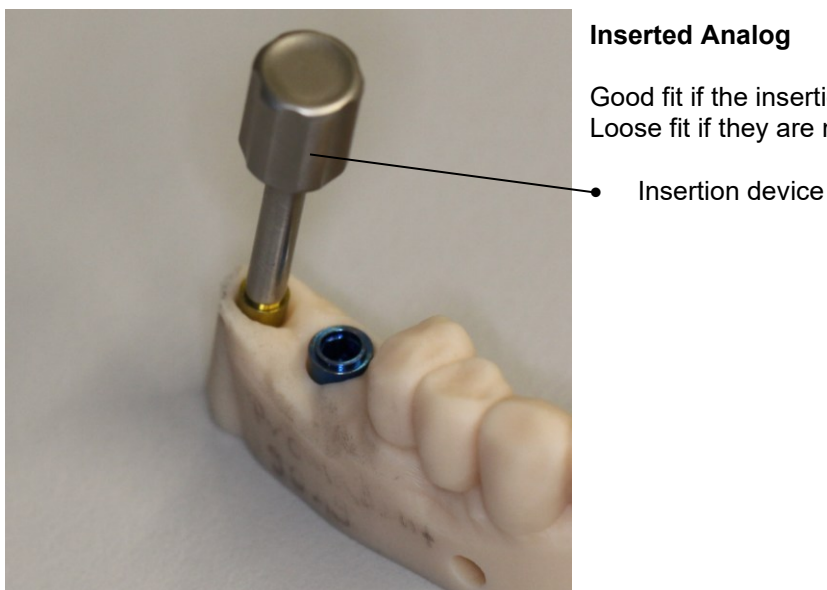
1. Overview

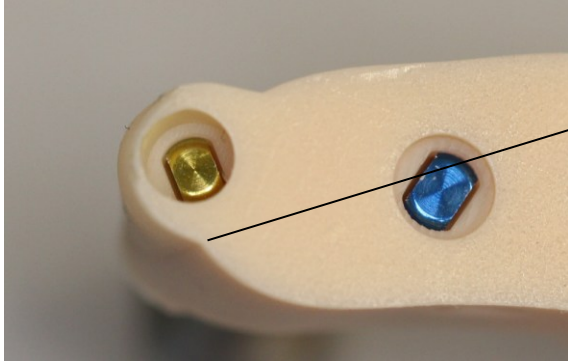
1.1. Nomenclature



1.2. Correct Insertion

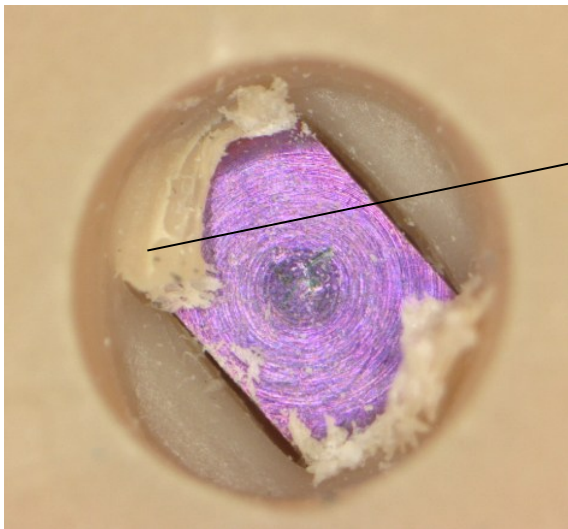
The Analog for CAD/CAM should be inserted using the insertion device without any excessive force. A feelable and audible "click" indicates that the analog is fully seated. Demonstration video: <https://youtu.be/SqakyCTZQgo>





Inserted Analog, apical view

- Good fit (no shavings)



Inserted Analog, apical view

Fit is too tight.

- Visible shavings

2. Cause and Effect

2.1. Effect

The Analog for CAD/CAM cannot be inserted into the analog socket, or it fits too loosely.

2.2. Cause

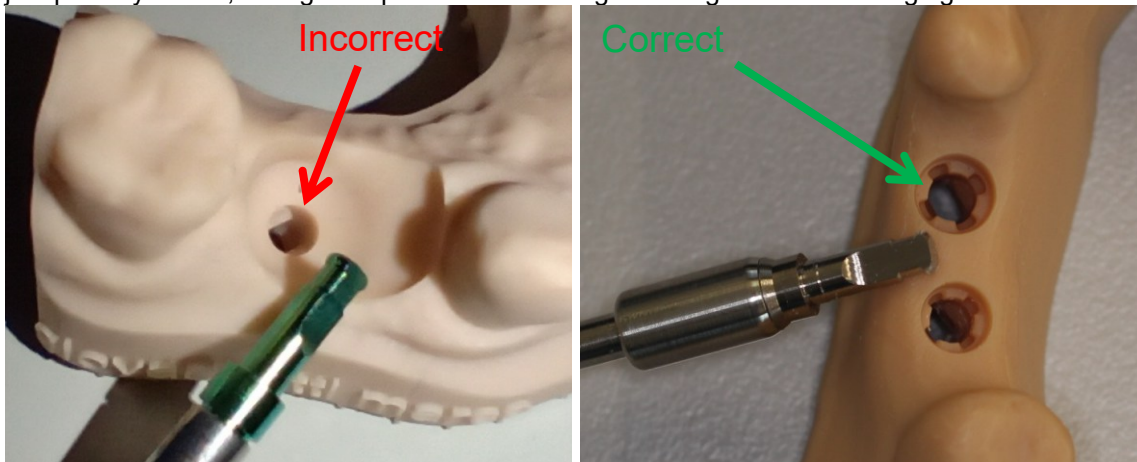
- Analog socket not generated correctly in CAD, see chapter 3.1
- Wrong analog type used, see chapter 3.2
- Platform diameter mix-up, see chapter 3.3
- Printer deviation (socket diameter deviates from STL), see chapter 3.4
- Wrong socket offset parameters, see chapter 3.5

3. Correction

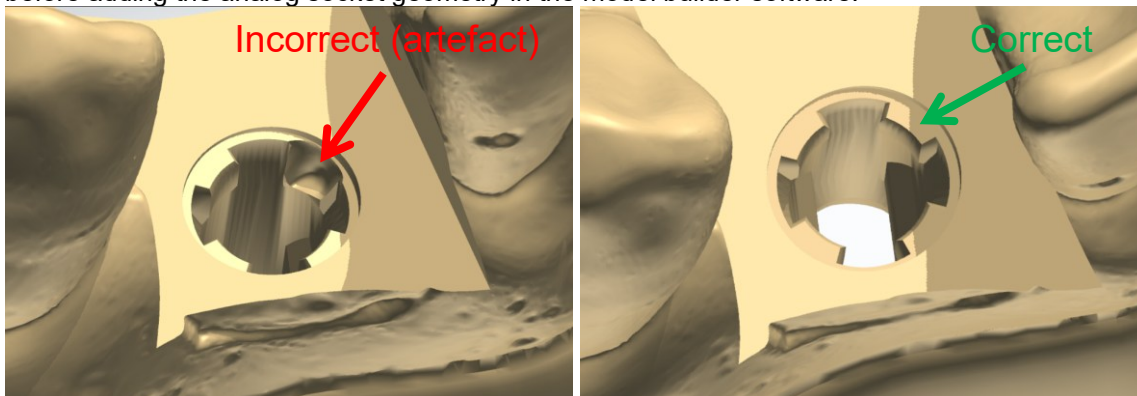
3.1. Analog Socket not Generated Correctly

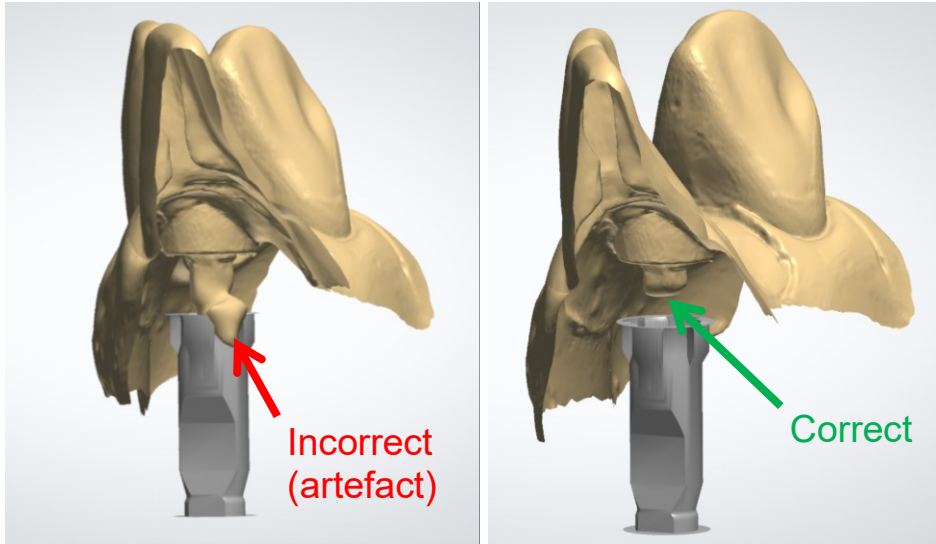
In some cases, the analog socket is not generated correctly by the model designer software, which removes parts of the socket geometry that are necessary to retain the analog. One cause can be that the removable gingiva cuts away the socket geometry. Currently the Exocad Model builder is prone to this issue.

Check if the four segments at the top of the socket are correctly generated. If the segments are not or just partially visible, change the parameters when generating the removable gingiva.



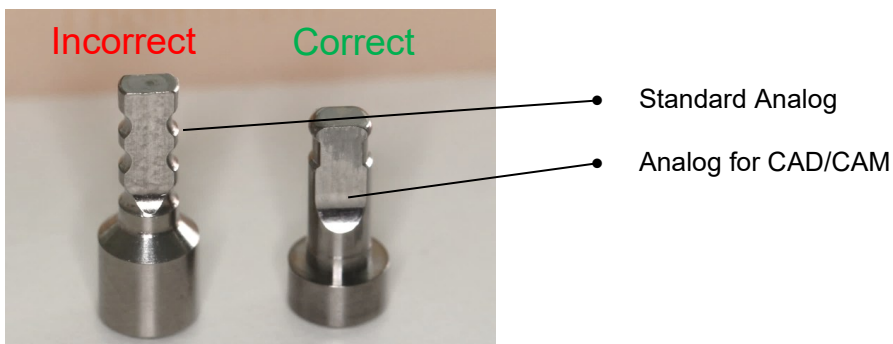
Scan artefacts in the internal implant connection geometry can also cause a bad socket by removing parts of the socket geometry. If this is the case, remove the artefacts from the scan and close any holes before adding the analog socket geometry in the model builder software.





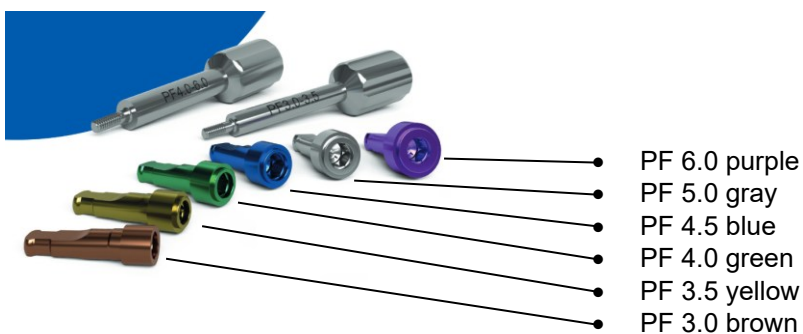
3.2. Wrong Analog Type Used

Do not use the standard analog for printed models. There won't click and the length is different.



3.3. Platform Diameter Mix-Up

Analogs for CAD/CAM are color coded for different Platform (PF) diameters. Place the same analog PF diameter into the model as was used in the CAD/CAM Software.

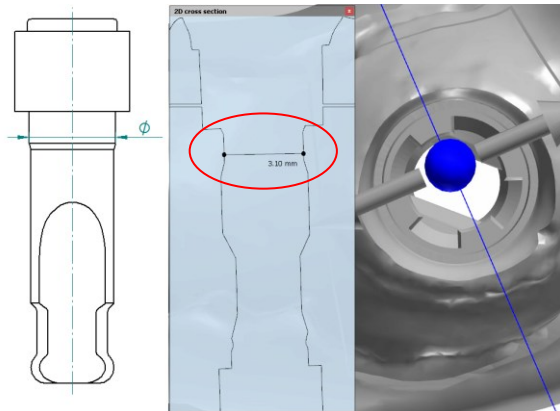


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Driven by science, not trends.

If PF diameter used in software is unknown, the STL model can be measured at the segmented part of the socket using the 2D cross section:



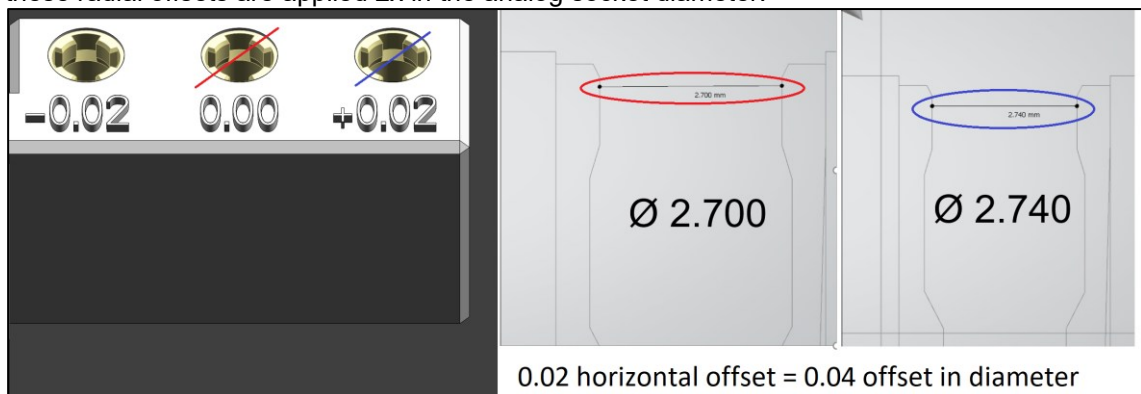
Diameter of segmented part of the socket

Platform	Diameter
PF 3.0	2.5 mm
PF 3.5	2.7 mm
PF 4.0	2.9 mm
PF 4.5	3.1 mm
PF 5.0	3.3 mm
PF 6.0	3.5 mm
VARIOmulti	2.9 mm

3.4. Printer Deviation

Some 3D printers tend to print sockets larger or smaller than modeled in the STL. If the deviation is constant, this can be fixed by compensating the deviation via an offset in the library. If the offset varies too much, the printing process needs to be improved. The deviation can be identified by printing a test plate and trying in which socket the analog fits best. The Test Plate of the PF3.5 can be found in the analog library. The Test Plate is for PF3.5 as this PF has the most critical shape.

- Print "Testplate-PF35.stl"
- Use a PF 3.5 analog to test which horizontal offset it fits best (+0.02, 0.00 or -0.02). Note that these radial offsets are applied 2x in the analog socket diameter:



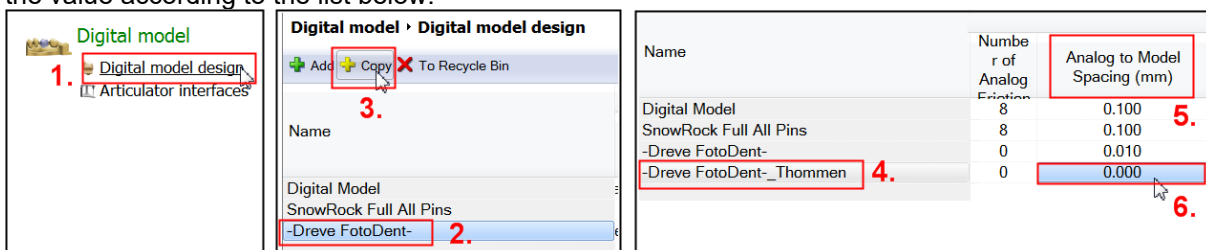
- Apply the offset to your model design parameters as seen below in section 3.5.

3.5. Wrong Offset Parameters

Setting Parameters in 3shape

To achieve optimal results with implant analogs sockets in printed models, 3shape Dental System allows for adjusting parameters in the model printing CAD settings. If you source your printed models externally, please ensure that you have up to date material libraries from your print service provider.

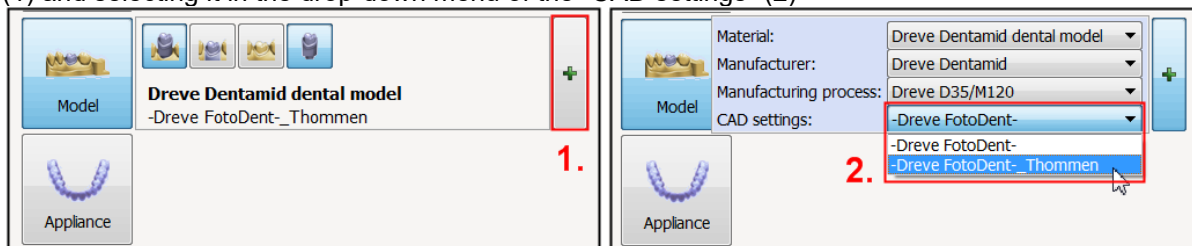
To adjust the parameters, open the Control Panel and click "Digital model design" (1). Then select the print process you usually use (2) and copy the profile (3). Rename the copy using "_Thommen" at the end (4), scroll to the far right and look for the parameter "Analog to Model Spacing" (5). Change enter the value according to the list below.



Printer	Value for «Analog to Model Spacing»
Prodways	0.000
Stratasys	0.025
Formlabs2	0.025

Save and exit the Control Panel.

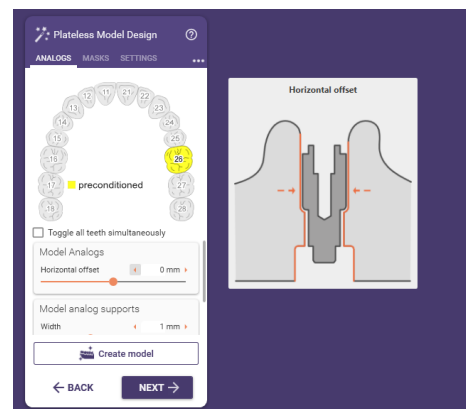
When creating a new case, it is now possible to select the new model CAD parameter by clicking on "+" (1) and selecting it in the drop-down menu of the "CAD settings" (2)



Setting Parameters in Exocad

To achieve optimal results with implant analogs sockets in printed models, Exocad DentalCAD allows adjusting parameters while designing the model in Model creator.

The parameter can be adjusted in Step "Plateless Model Design". A negative value tightens and a positive value loosens the gap between the analog and the model.

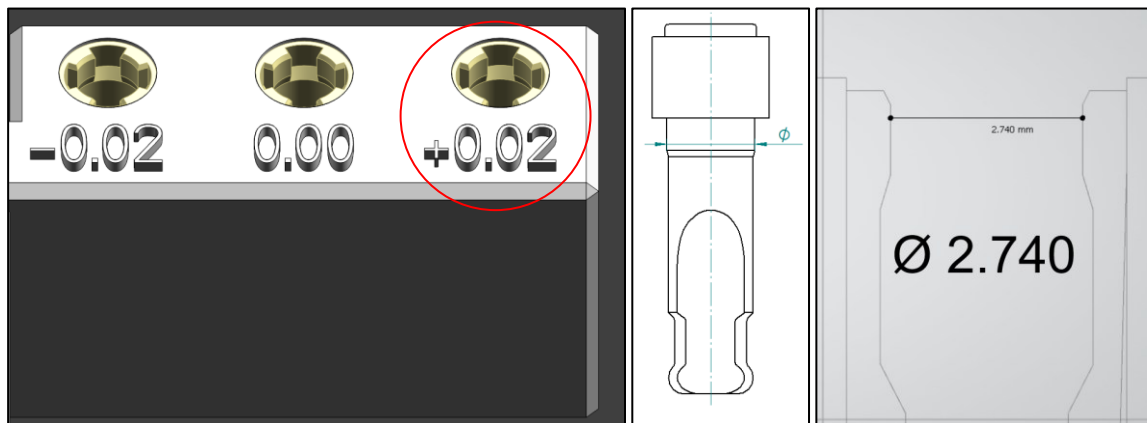


3.6. Verify Socket Diameter

The "horizontal offset" (exocad) or "analog model spacing" (3shape) can be verified by measuring the socket diameter in the stl model output file.

Caution: The offset/spacing is applied on each side of the socket, so it shows as double the value if the diameter is measured.

Example: The PF 3.5 analog fits best into the +0.02 socket of the test plate and the parameter +0.02 is applied according to section 3.5. The socket diameter in the model cross-section will measure:
 $[PF \text{ Diameter at Segment}] + [2 \times \text{Horizontal Offset}] \rightarrow 2.70 + 2 \times 0.02 = 2.74$



Platform	Diameter
PF 3.0	2.5 mm
PF 3.5	2.7 mm
PF 4.0	2.9 mm
PF 4.5	3.1 mm
PF 5.0	3.3 mm
PF 6.0	3.5 mm
VARIOfulti	2.9 mm