Figure 1.

Milling technique: Dentures without clasps

Part 2: Telescopic crowns

By Frieder Galura

"The advantage of telescopic dentures is an easy repair proposition after the extraction of a supporting tooth although we may have to look for other technical solutions in the case of large abutment divergences..."

We will start this second part of this article by listing the basic requirements for the dental milling technique.

1. Dental milling machine (Figure 1) - The development of the dental milling technique started in Switzerland in 1935 by the dentist Dr Steiger and master dental technician Frey. The first milling machines worked on the principle of upright-drilling machines. The milling object was moved against the milling tools, which made the handling difficult to say the least. Modern milling machines (Paramil 3, Dentaurum Germany) have three-dimensionally moveable milling arms and are equipped with micromotors, which are used in preference to those with pressed-air turbine drives. When working in situations with low rpm, the latter have no torque so milling is rendered fairly useless. If the rpm is going up to 100,000 rpm, thin milling tools will no doubt be bent.

2. Milling wax (Figure 2) - A milling wax of premium quality (Starwax M) shows good properties by milling and scraping. It doesn't smear and provides for smooth surfaces.

3. Wax-milling burs (Figure 3) - Wax-milling tool cutters have special geometry according to their purpose.The recommended rpm is approx. 3000 rpm. You can also use twist drills for milling 0º.

4. Milling tools (Figures 4 & 5) - There are a vast number of milling tools on the market. The quality of the milling tools have a direct effect on the result of the milling surface, so always use quality tools. It is recommended to work at approx. 8000 rpm. Rotations which are too high cause a "whiplash" effect, especially when working with thin milling tools. Cross cutters with a diameter of 1.5mm provide surfaces without "rattle signs" when milling CoCr based alloys.

5. Milling oil (Figure 6) - The use of milling oil is necessary for cooling and lubrication. The quality of the cutters are prolonged approx. 25% when oils are used. Milling oils are synthetic, which doesn't resinate due to heating from friction. However, not every oil is suitable for this purpose.

6. Diameter of the shaft - 2.35mm or 3mm? - Most dental milling machines are supplied with a practical quick-chuck for shaft diameters 2.35 and 3mm. Working with a shaft diameter 3mm isn't advantageous in regards to the turning precision of a milling tool. Thin milling tools with a shaft diameter of 3mm are bent just as easily due to high rotations and high pressure as those with a shaft diameter of 2.35mm. A uniform diameter of the milling cutter and the shaft is ideal from an industrial view of milling technique.

Milling directions

Climb milling: A right-turning milling tool is moved from the left to the right side (Figure 7) along the surface of a milling object - the so-called *contour.* This process is described in terms of the milling technique as *climb milling* or *cut-up milling.* The milling tool is moved on the right side of the contour (Figure 8). This milling direction is recommended for new cutters and used for *rough milling.*

Figure 2.

Figure 3.

Figure 4.

Figure 5.

Figure 6.

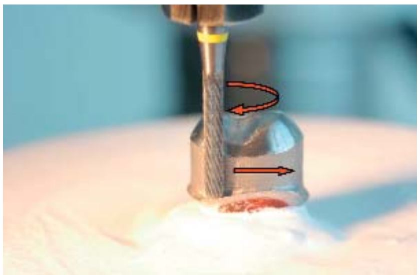

Figure 7.

Figure 8.

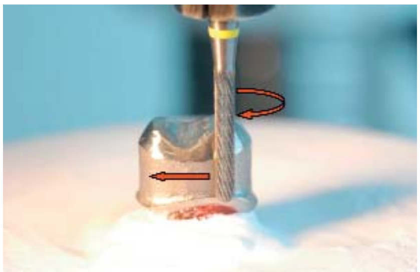

Figure 9.

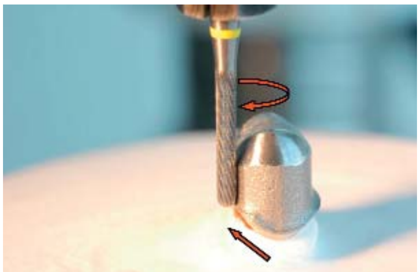

Figure 10.

Figure 11.

Figure 12.

Figure 13.

Figure 14.

Figure 15.

Figure 16.

Figure 17.

Figure 18.

Figure 19.


Figure 20.


Figure 21.

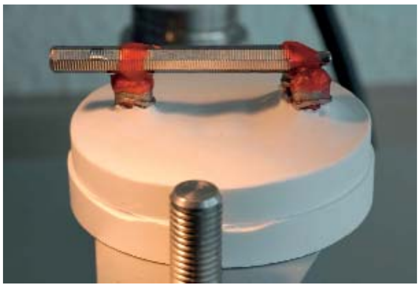
Figure 22.

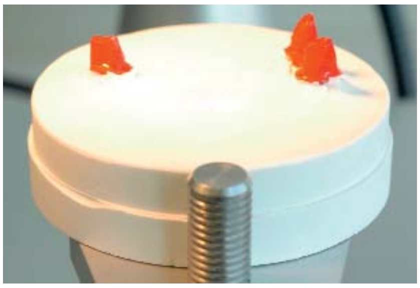
Figure 23.


Figure 24.

Figure 25.


Figure 26.


Figure 27.

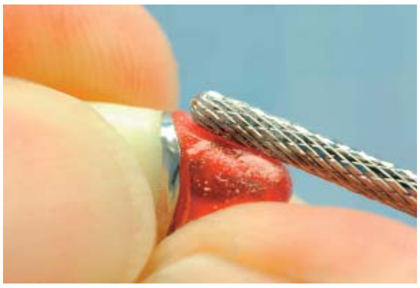
Figure 28.


Figure 29.

Conventional milling: Milling is also completed with a right-turning cutter from the right side to the left (Figure 9) and is described as *conventional milling* or *cut-down milling*. The milling tool is moved on the left side of the contour (Figure 10) and causes a smoother surface. This process is used for *fine milling*. Conventional milling is also used for wax-milling.

Telescopic crowns

The telescopic technique is used for shock absorbing or the transmission of highly mechanical forces. In dental technology, telescopes are used as retaining elements. The advantage of telescopic dentures is an easy repair proposition after the extraction of a supporting tooth although we may have to look for other technical solutions in the case of large abutment divergences. Another disadvantage is a higher loss of dentine material in the supporting teeth due to preparation to obtain a better result of the double crowns from an easthetic point of view.

In any case, a shoulder preparation is the best precondition (Figure 11). We begin the surveying of the insertion path in the anterior area to ensure that the margin of the secondary crown is corresponding with the one of the gingiva (Figures 12 and 13). The primary crowns made of milling wax (Starwax M, Dentaurum, Germany) are milled 0º with a wax bur or a twist drill (Figures 14 and 15). It is recommended to work with appr. 3000 rpm (Figure 16) to avoid smearings. After casting, the primary telescopes (Figure 17) and remaining parts of the sprues are provided with an undercut to be safely retained in the overimpression (Figure 18).

When the latter comes back into the lab from the try-in, the secondary master cast is fabricated. The primary telescopic crowns are joined with a stable instrument (Figure 19) for the removal. The inside of the crowns are insulated with vaseline and filled with resin (Figure 20). Screws, which are placed into the resin (Figure 21), stabilize the connection between the resin abutments and the master cast (Figure 22).

Figure 23 shows the milling base made of stone with the resin abutments. The telescopic crowns are milled (Figure 24) with approx. 8000 rpm (Figure 25) and polished. The secondary crowns (Figure 26) are modelled with resin (Figure 27) and ground back to a wall thickness of 0.2 - 0.1mm (Figure 28).

In the next step, the crowns are completed with wax (Figure 29). An "expansion chart" helps to achieve reproducable fits after casting (Figure 30). The investment compound Castorit all speed (Dentaurum, Germany) has a maximum expansion of 3.3% and is highly suitable for the casting of CoCr secondary parts. It's recommended to reduce the concentration of the mixing liquid to 80%. In Figure 31, you see the secondary telescopic crowns already joined with the cast partial. For this procedure, laser welding is "state of the art" (Figure 32).

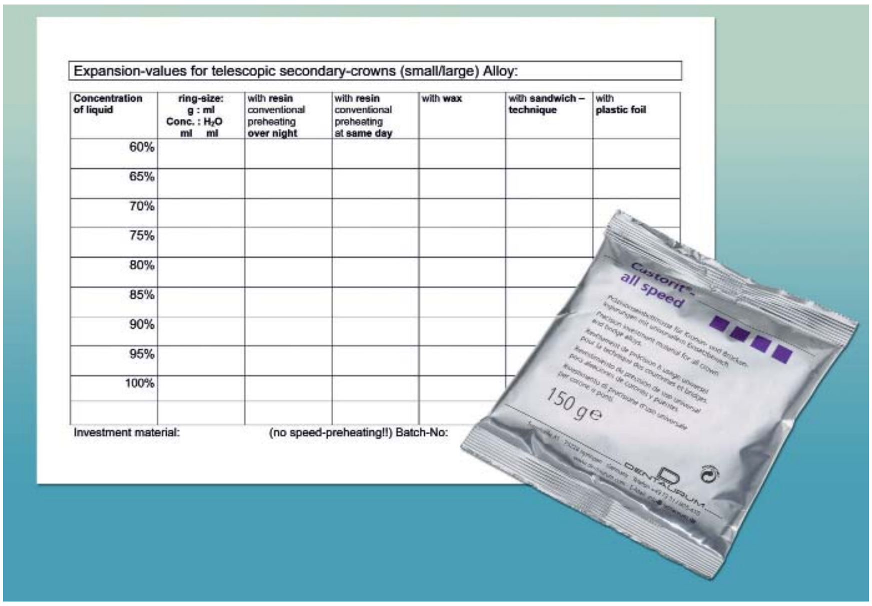

Figure 30.

Figure 31.

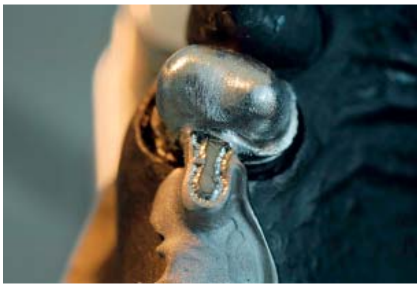

Figure 32.

This article will be continued in Part 3: Conical crowns.

About the author

Frieder Galura trained as a dental technician at the University Dental Hospital in Heidelberg, Germany. He has worked in many dental practices and laboratories in Germany, concentrating on ceramics, milling work and attachment techniques. He commenced working for Dentaurum as dental technician in the prosthetic department in 2002 and has lectured and run training programmes for them both in Germany and throughout the world. Since 1995, he has been published in dental technical magazines in Germany, France, Spain, Italy and Japan.