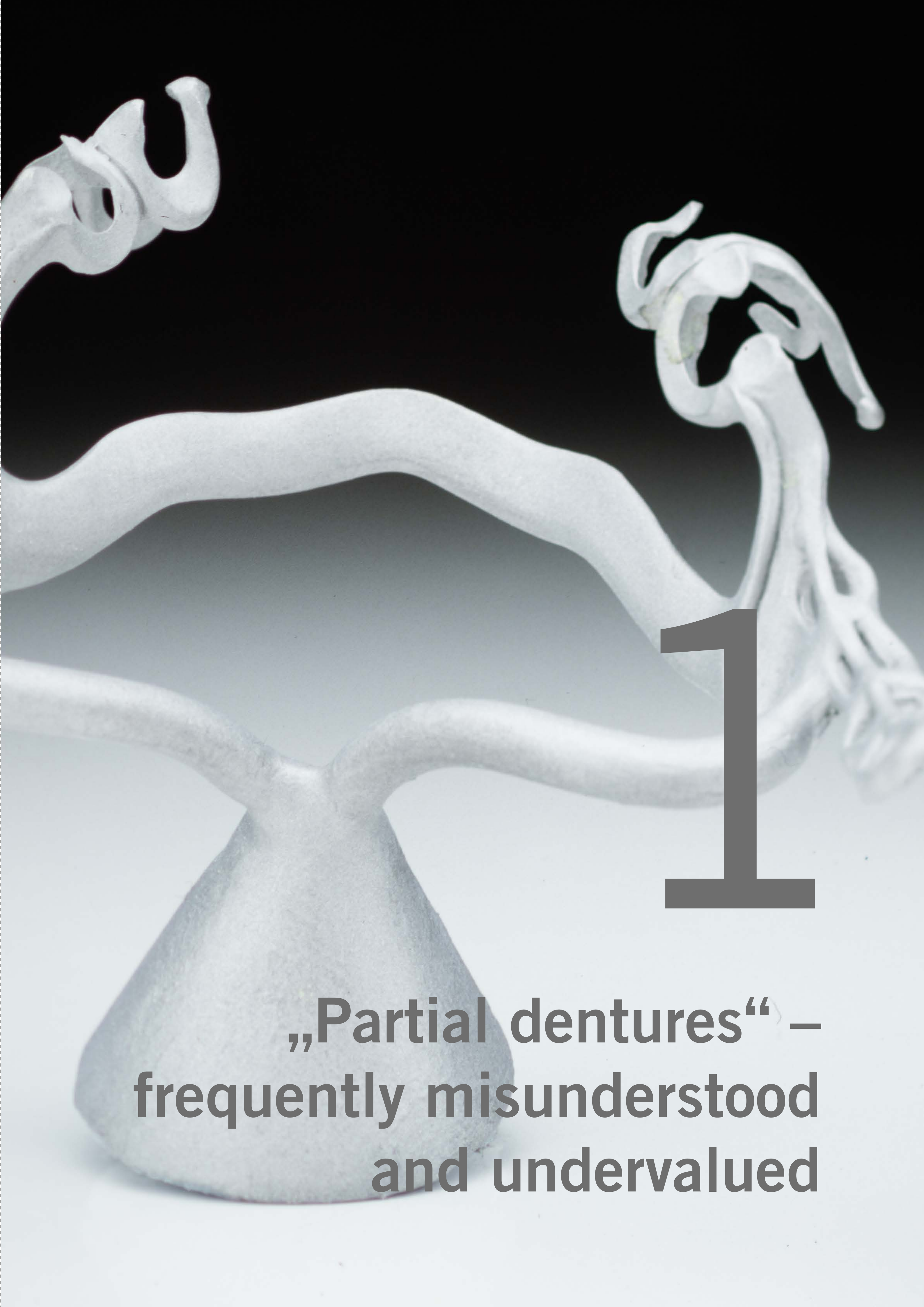

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„Partial dentures“ – frequently misunderstood and undervalued

Guidelines for planning and design

In this multi-part series, the author describes the ideal treatment approach using clasp-supported partial dentures. He advocates the opinion that the functional duration of such prostheses can be considerably extended if the frames are designed with a “system and concept”. A fault- and error-free partial denture frame rules out any complaints from the start and thus saves the laboratory unnecessary additional costs.

Mandibular frame made of WIRONIUM®

Avoiding typical mistakes

A partial denture does not inevitably have to be replaced with a full denture after a few years.

The causes of premature loss of functionality are diverse and, amongst other things, can be put down to:

- Incorrect model measurement resulting in too low or excessively high removal forces
- Poor choice of clasp, this can have a negative impact on insertion and removal
- Significant prosthesis rotation from a failure to observe static rules
- One-side shear loading on abutment teeth due to a lack of a “counterbearing” upon removal
- Excessive loading of abutment teeth from insufficient base/ saddle expansion
- Unsuitable, barely flexible alloys or brittle frames as a result of overheating during melting

Partial dentures as a standard treatment

From a global perspective, partial dentures, produced essentially on the basis of a partial denture frame, are now the standard form of treatment for partially edentulous jaws. Due to successes in preventive dentistry, the partial denture frame has replaced the full denture as the leading standard treatment. In Germany around 30 % of senior citizens wear partial dentures, for the most part in the lower jaw. The advantage of clasp-retained partial dentures is that hardly any natural tooth substance is lost due to trimming and they can be produced with relatively little effort. Moreover, when the denture is removed, the remaining teeth can be easily accessed for cleaning. Unlike with a bridge restoration, large lost mucosal areas are replaced. On the down side, visible clasp ends can be aesthetically unpleasant. In contrast to structures with attachments, double crowns and bars, the removable part of a clasp-retained denture is less “rigidly” connected to the residual dentition. This can result in excessive denture rotation which must be avoided.

The challenges of clasp-retained partial dentures

With teeth with gaps, there are often not enough natural teeth available for a well-balanced denture design. Where there is limited dental support, undesirable tilting results from the resilience of the tissue. Targeted planning and design help to ensure the static balance of a denture.

The clasped abutment teeth are subjected to horizontal and vertical forces when the denture is inserted and removed and when chewing. Upon removing the denture, the clasp sections above the constructive equator inevitably are no longer in contact with the tooth. The retentive clasp sections (spring arms) which are still in contact, are subjected to higher tensioning. The bending clasp has to “overcome” the equator, it opens slightly yet still exerts an, in part, strong horizontal shear force on the abutment tooth. The focus here is developing a design which prevents these critical horizontal forces on the remaining teeth as far as possible. The removal and insertion process of clasp-retained dentures is always highly critical. Unlike with parallel-walled fasteners such as telescopic crowns, rod attachments and bars, the abutment teeth are subjected to, in part, strong shear and traction forces. To this end, an intelligent design must be found which minimises these disadvantages as far as possible. Even minimal tilting of the denture can result in overloading of the abutment teeth leading, in turn, to premature tooth loss. A denture which is guided by the “rigid” clasp sections in contact with the abutment tooth on insertion and removal, is subject to less deflection. This is comparable with the functionality of attachment prostheses.

Stable solution made of WIRONIUM®

Attachment prosthesis on pilars made of Wirobond®

When measuring the model, correspondingly favourable clasp paths can often be achieved through the targeted selection of the clasp or an adequate denture path of insertion. To this end, a slight change in position of the model on the planning table is frequently sufficient. Ideally, when removing the denture, the rigid clasp arm or the small connector should remain in contact with the abutment tooth until the retentive clasp section has overcome the constructive equator. After all, loading of the abutment tooth should be axial, significant horizontal shear forces inevitably result in loss of the abutment tooth. It is only when measuring the model that it becomes clear whether the desired counter bearing function, e.g., with greatly curved teeth, can be realised. Should this not be the case, the necessary retention must be spread over several or additional undercut areas. Clasp-retained partial dentures are only stress-free in their final position and there is a resulting strutting effect.

Important design principles for partial denture design

It is of the utmost importance that the individual load capacity of the abutment teeth is observed.

This is a prerequisite for long-term and fault-free functionality. Amongst other things, this is achieved via:

- Careful clasp measurement with adjusted undercut values
- Supports far from the saddle with free-end saddles
- Double-sided support of tooth-borne saddles
- Corresponding creation of retention areas, e.g., buccal on both sides
- Large-area bases to relieve strain on critical abutment teeth as, thanks to these, the forces applied are spread over a larger area
- Rigidly connected opposite denture saddles
- A denture base which does not cover the marginal periodontium
- Restriction of denture rotation to avoid premature abutment loss. Ideally with a short action lever arm and a long resistance lever arm
- Creation of the denture saddle over a large area
- Non-loading of distal saddle third or shortened teeth row if relevant

Stably designed clasp section above the constructive equator secure the denture against horizontal shear forces. Retentive clasp sections (clasp spring arms) below the constructive equator require a slender design. Under no circumstances should they be larger than necessary for a secure fit.

There should ideally be precise contact between the denture base and the mucosa which supports the denture. This needs to be checked regularly (ideally every six months) by the dentist. A perfect denture fit, especially in the saddle area, is not only important for the masticatory function, it is also vital for secure denture fit and a guarantee for ideal functionality.

Aspects of material properties and dental realisation

The choice of alloy is of central importance for the functionality and lifespan of a partial denture. Good tensile strength reduces the risk of breakage and also rules out permanent deformation. High ductile yield allows the practitioner to make adjustments without these having a negative effect on the spring force. A high chrome content guarantees good corrosion resistance. The dimensions of the prefabricated wax clasp profiles should be tailored to the specific alloy. Highly flexible proprietary alloys from well-known providers ensure the slender look of the clasp and a secure hold without comprising in terms of functionality. The clasp dimensions result from the chosen profiles. The dental technician determines the fit of the denture by selecting the clasp length, undercut and path – either on or below the constructive equator.

WIRONIUM® – High elongation at break and corrosion resistance

The clasp dimension is determined by the selection of the respective profiles. With the determination of the clasp length, its undercut and course – on or below the constructive equator – the dental technician determines the denture support.
Careful and gentle melting of the alloy leads to fine-grained microstructure; the „good“ material properties are maintained. Improper overheating not only increases the risk of fracture, rather, an overheated framework loses its retention force. Modern casting machines help to find the ideal timing for casting in order to avoid overheating and shrinkage.

Flat casting strips

In many cases, largely uncontrolled, excessive electrolytic polishing is the cause of malfunctions. Avoiding polishing altogether complicates the work process. However, systems or devices should be used which are easy to control and which result in an even and gentle removal of material.

Nautilus CC plus with automated casting process

The casting channel system also has an influence on the casting result or the quality of the alloy. More than two casting channels are rarely required when using modern casting systems. In the upper jaw, preferably flat sprues are used to avoid shrinkage.When the liquefied alloy is shot into the casting cavity, no turbulence is created.

Gentle polishing with Eltropol 300

The Ney system, practiced since the 1950s, needs to be modified. In the meantime, better alloys of higher strength and elasticity are available, which allow new, partly less invasive clasp shapes. These allow the frameworks to be made more delicate, particularly with regard to the clasps and transitions. How this can be implemented in practice is described in detail in the following chapters.