

Competence in

# Implant Esthetics



Manual

**Implant Superstructures**  
for Crown and Bridge Restorations



Cultural historical finds indicate that humans tried to replace missing teeth by homeo- or alloplastic materials (human or animal teeth, carved bones, ivory or mother of pearl items) from very early on. What is known as dental implant today was first inserted towards the end of the nineteenth century. Today's customary implant shape was inspired by that of the natural root of the tooth and used for the first time in 1939. Since that time, implantology has been continuously further developed and has become an important element of dental restorative treatment.

Dental implantology requires well-founded professional skills and experience from all the parties involved, i.e. dentists and dental technicians. This Manual will provide a short introduction to implantology, as well as the planning and realization of prosthetic treatment options. In addition to the theoretical basics, the fabrication of various implant superstructures is described step-by-step. This Manual is intended to support you in your daily work.

*The dental labwork was carried out by INN-KERAMIK, Innsbruck/Austria, who also provided the pictures.*

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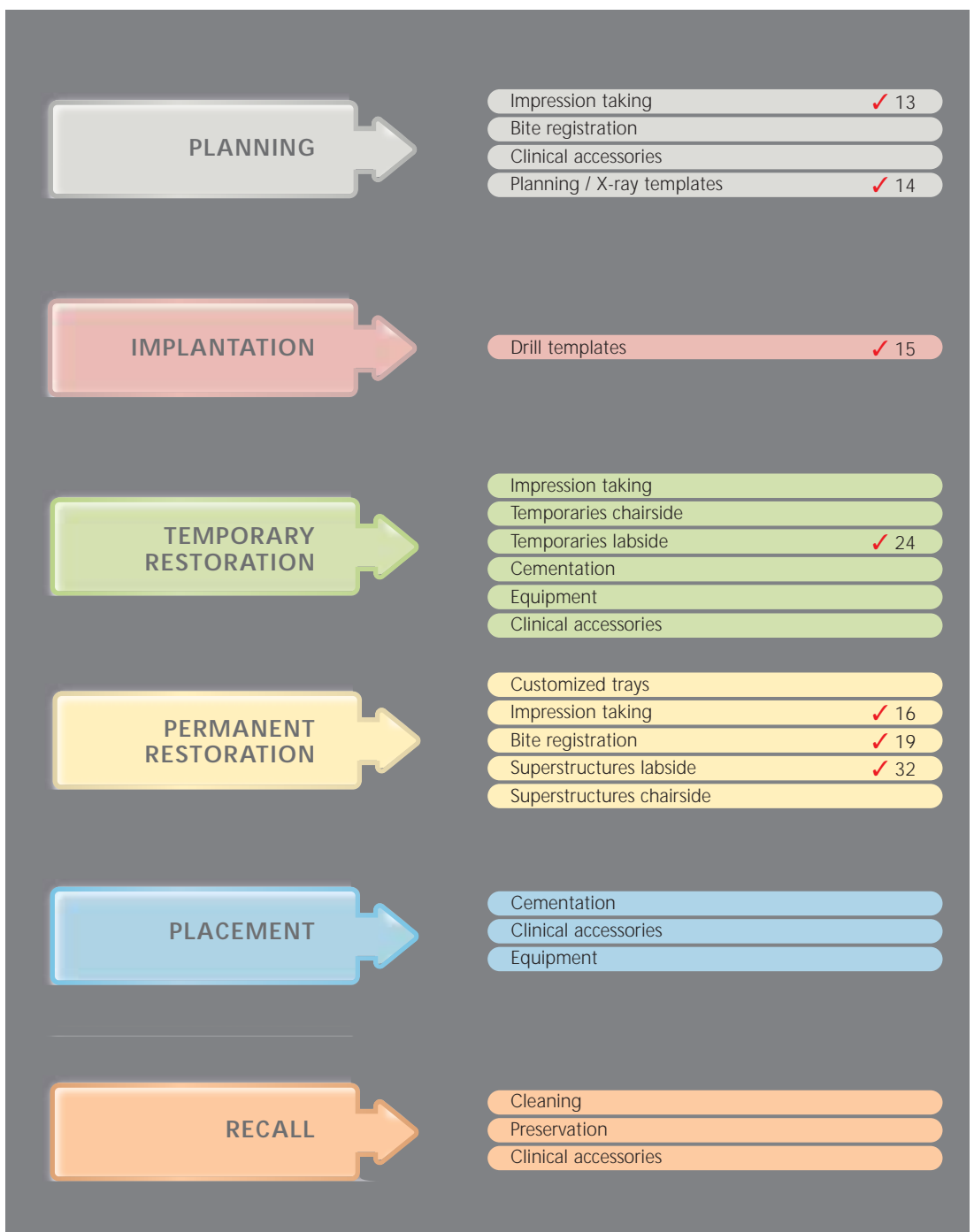
# Navigation

The fabrication of a functional and aesthetic implant-retained restoration involves interwoven clinical and technical procedures for which various dental products are used.

This Manual describes the different procedures for the fabrication of implant-retained prosthetic restorations.

The navigation shows the sequence of procedures for an implant-retained restoration in six main working steps. Each step is again divided to provide a more detailed overview of the individual processes.

The red ticks within the working steps indicate the processes explained in this Manual. The colour code should make it easier for you to identify the individual processes.

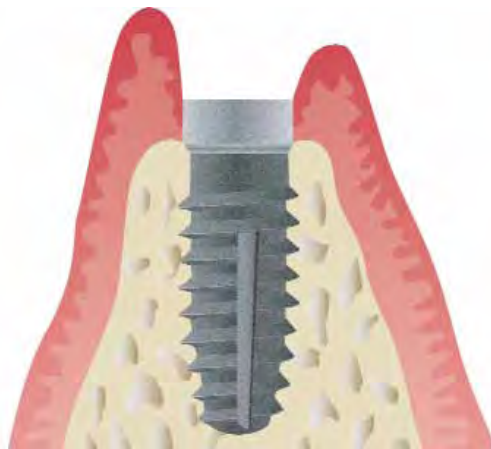


## Introduction to dental implantology

**Implantology** is the science of implanting foreign (alloplastic) materials to replace endogenous (lost) organ functions with the objective of tissue-friendly setting (bio-integration). Dental implants may also be called artificial roots which are implanted into the jaw bone in the place of missing teeth.



In dentistry, dental implants are alloplastic materials, which are incorporated in the area of the mucous membrane-periosteum epithelium and/or the jaw bone in order to retain dental restorations. We are working with open implants in dentistry, which are in permanent contact with the germ-laden oral cavity.



Oral implantology distinguishes between five different implant types. However, intra-ossal implants are considered the implants of choice today. An intra-ossal implant is an implant that is directly anchored in a bone.

### Area of application of intra-ossal implants:

- *Immediate implant which is inserted during the same appointment*
- *Standard implant which is inserted 4 to 6 weeks after tooth loss*
- *Delayed implant which is inserted only once the bone in the alveolar cavity has healed. These implants are used as retention elements for hybrid dentures or as abutments for fixed crowns and bridges*

With intra-ossal implants, the osseointegration of the implant can be achieved. The term osseointegration describes the direct, functional, and structural bond between the organized, living bone tissue and the surface of a treated implant, which is visible under the light-optical microscope.

## Factors of successful osseo-integration (implantation)

- Patient selection**
- healthy oral and overall situation of the patient
  - correct information of the patient about the treatment procedure and the intended treatment result
- Bone quantity**
- the available bone structure of the maxilla and mandible determines the indication and the selection of the implant system
  - in case of an atrophied alveolar process, reconstruction of bones by means of augmentation techniques
- Bone quality**
- the suitability is determined by two different bone structures (compacta, spongiosa) and is sub-divided into four categories I-IV
- Implant material**
- the requirements, such as mechanical strength, biological compatibility, and stability, must be met
- Implant surface**
- biocompatible materials with a structured surface induce the settlement of bones
  - smooth surfaces at the neck section of the implant reduce plaque accumulation
- Implant shape**
- Blade implants
  - Needle implants
  - Screw implants
  - Cylindrical and root-shaped implants
  - Combined implants
- Implantation planning**
- implantation should be preceded by a careful planning stage, in which the number, position, and length of the implants are determined
- The following pre-operative planning tools are prepared:*
- General and dental anamnesis
  - Extra- and intra-oral findings
  - Functional analysis
  - Fabrication of diagnostic casts
  - Mounting of the models in the articulator (facebow, determination of TMJ relations)
  - Wax-up, diagnostic tooth set-up
  - Radiological examination
  - Photographic documentation

## **Surgery**

Surgical procedures in the implant technique are divided into:

- soft tissue intervention (gingiva, mucosa)
- hard tissue intervention (bone)

The planned implant position of the diagnostic model is transferred to the intra-oral situation with the help of a drill template or a navigation system.

## **Superstructures**

*Fixed or partly removable:*

Individually fabricated crowns and bridges

- purely implant-retained
- one or several implants connected with natural abutment teeth (hybrid bridge)

*Removable or partly removable:*

- implant-retained over dentures
- implant-retained hybrid dentures

## **Occlusion**

- With implant-retained superstructures, the aim should be axial load and multi-point contact in the centric position with unimpeded excursive gliding movements. Several occlusion concepts are distinguished (BB = bilateral balanced occlusion; CG = canine guidance, GF = group function)

## **Oral hygiene**

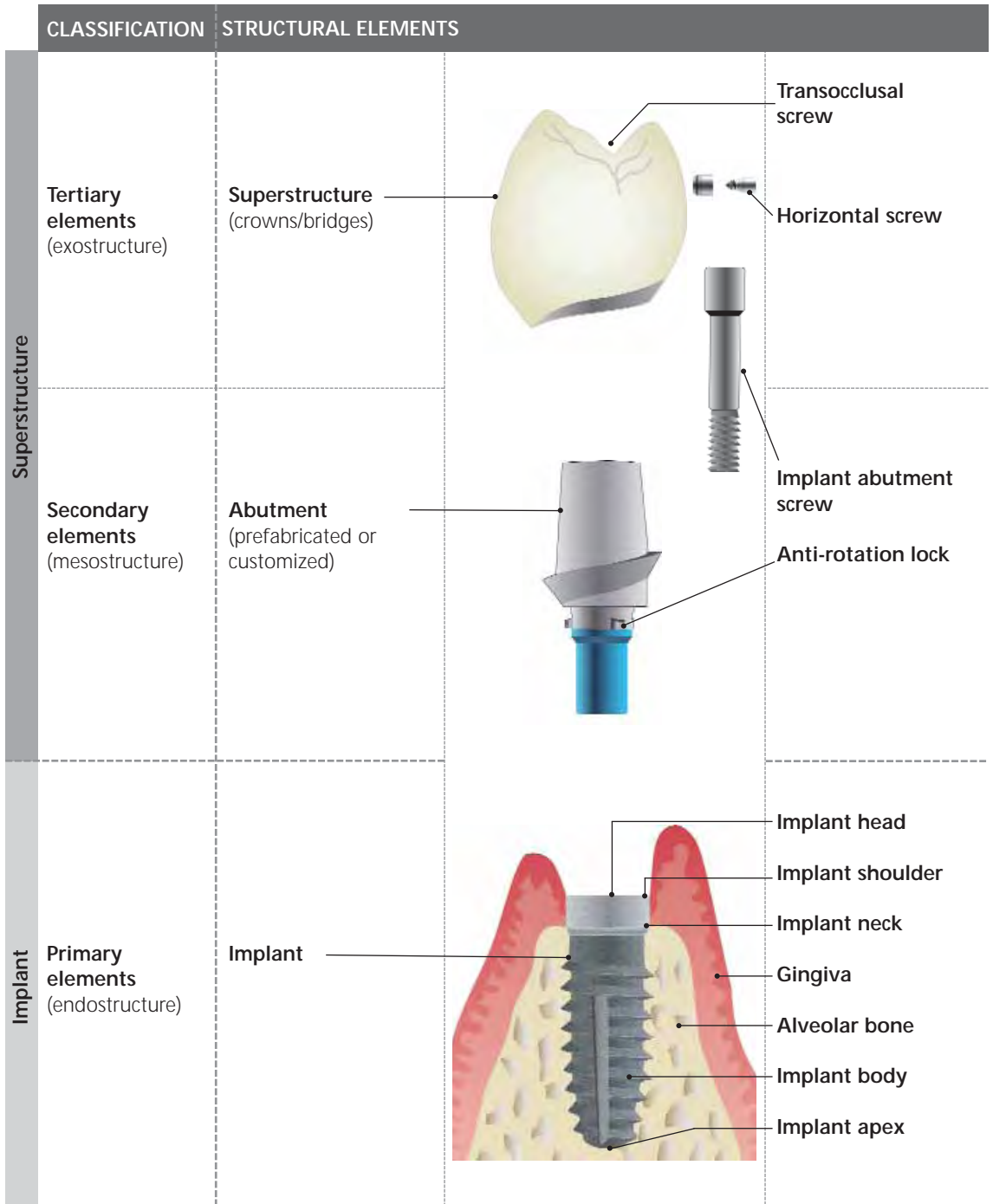
- Patients are instructed in advance on the independent cleaning of the implants and superstructures in order to perform adequate oral hygiene (interdental brushes have proven most successful).

## **Aftercare**

- Optimum oral hygiene on the part of the patient is necessary for the long-term success of intra-ossal implants. Additionally, patients should have regular dental check-ups and professional oral hygiene appointments.



# Structural elements





## Implant

The term implant describes the part of an implant system that is anchored in the jaw bone. The implant can also be called 'artificial tooth root'.

### Primary element / endostructure = "Implant"

- Implant apex**
- The implant apex is the lower (apical) part of the implant body, through which the vertical force exerted on the implant is transmitted to the jaw bone. Screw implants transmit the vertical force via the thread into the bone.
- Implant body**
- The part of a root replacement that is positioned in the bone (intra-ossal) is called the implant body. The coated, perforated implant bodies are classified into hollow body and solid body implants.
- Implant neck**
- The implant neck is located between the implant body in the jaw bone and the implant shoulder. An implant neck with a machine-treated surface prevents plaque accumulation. Given the subgingival placement of the implant neck, the mucous membrane may adapt without irritation. Implants inserted into the alveolar ridge do not require a pronounced implant neck.
- Implant shoulder**
- The implant shoulder is the transition between the implant neck and the implant post. The implant shoulder is narrow with a machine-treated surface and may be bevelled to improve the aesthetic appearance.
- Implant head**
- The implant head is the most coronal part of the implant and it represents the connection to the implant post or directly to the superstructure. There are implant heads with (for single crowns) and without anti-rotation lock (for bridges). If an anti-rotation lock is present, it can be integrated within or outside the implant head.

## Superstructures

A superstructure comprises everything that is retained by the implant and protrudes into the oral cavity, i.e. secondary and tertiary elements.

### Secondary element / mesostructure = «Abutment»

#### Abutment

- The abutment is the part of a one- or two-phase implant system which is connected to the implant or fixed to it. It is the build-up that protrudes into the oral cavity, which is either directly included into the superstructure or which serves as a connection element between the implant and the superstructure.

#### Implant abutment screw

- The implant screw, also called abutment screw, is used for a rigid, mechanically stable connection between the implant, abutment, and superstructure.

### Tertiary element / exostructure = «Superstructure»

#### Superstructure

- The superstructure is the prosthetic restoration that is either directly or, in most cases, indirectly connected with the implant. It may be retained on implants and natural abutment teeth at the same time. Depending on the type of connection, superstructures are classified into fixed, partly removable, and removable superstructures.

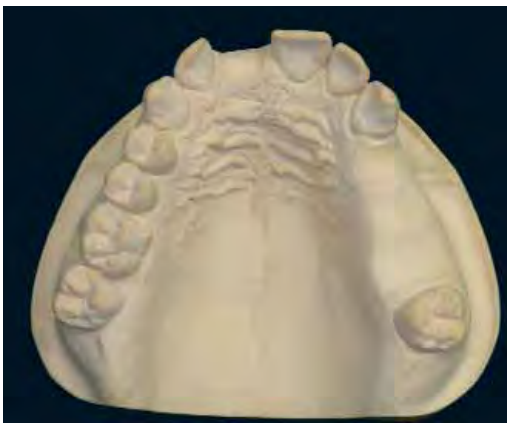
#### Horizontal transocclusal screw

- With this screw, superstructures are screwed down transocclusally or horizontally to form partly removable structures.

# Planning of implant-retained prosthetic restorations

The main objective of implant-retained prosthetic reconstructions is the restoration of the function. By means of augmentative procedures and membrane techniques, implants may be inserted wherever they are useful in connection with interdisciplinary treatment planning and permit good aesthetic results. Aesthetic aspects have become increasingly important in implant prosthetics. The possible treatment plan and prosthetic restoration should be defined in advance by the entire team consisting of jaw surgeon, dentist, and dental technician.

A carefully prepared, prosthetics oriented implantation plan is indispensable for correct positioning and dimensioning of the implants. Only in this way may prosthetic superstructures be fabricated that meet the requirements regarding function, phonetics, oral hygiene, and aesthetics.



Implant-supported restorations have to be fabricated with utmost precision, since, in contrast to teeth, implants do not feature a periodontal ligament. This means that purely implant-retained restorations transmit the masticatory forces directly onto the jaw bone. Observing gnathological principles is thus the prerequisite for successful implant prosthetics. An arbitrary facebow for the articulation of the maxilla and a centric registration to determine the TMJ relations are considered the absolute minimum requirements to be fulfilled.

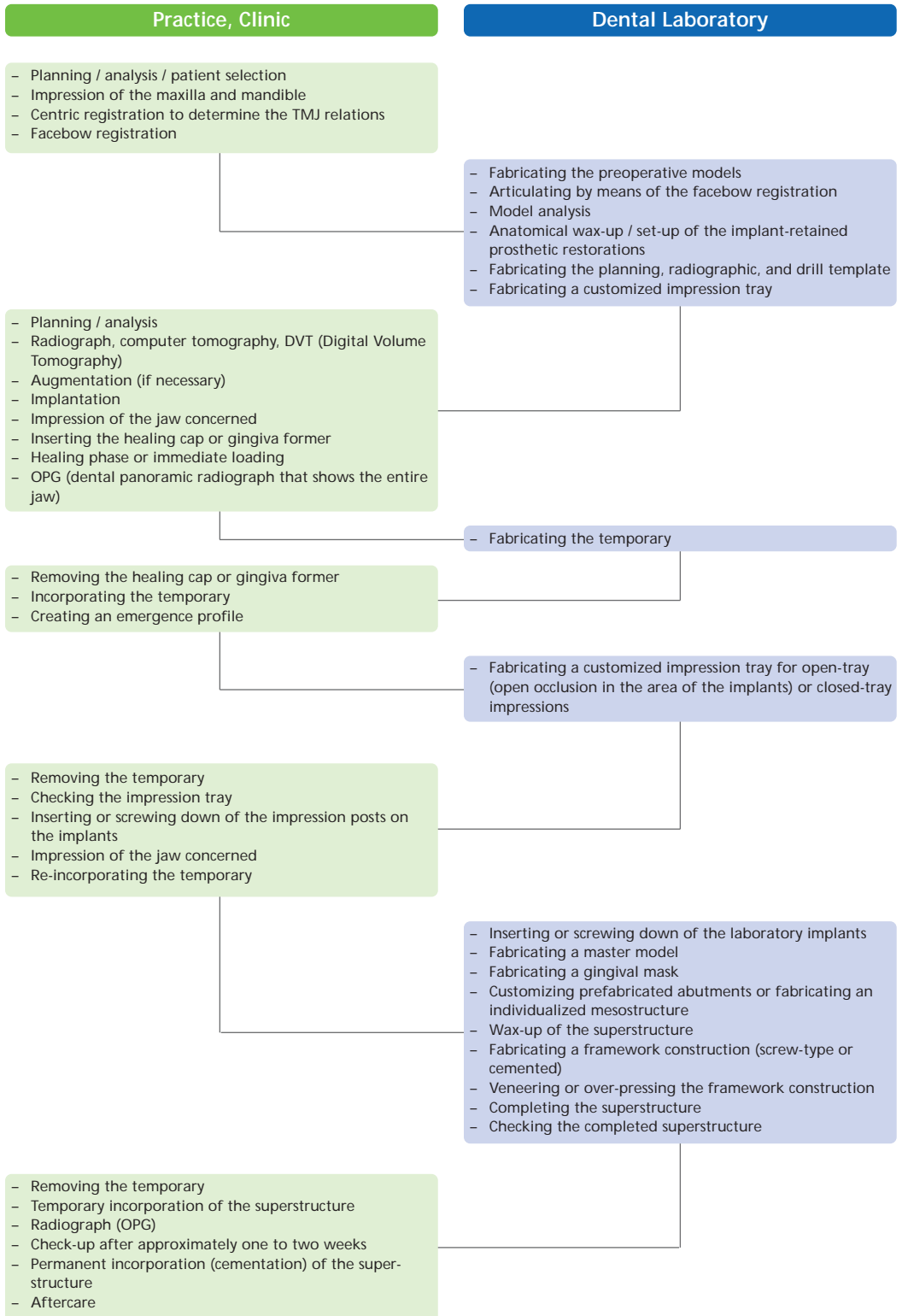


Stratos® 300, UTS 3D Transferbow

## Clinical and laboratory procedures

### for the fabrication of implant-retained superstructures

The clinical and laboratory procedure for the fabrication of implant superstructures shown below represents one option and is related to the superstructures presented in this Manual.



## Planning

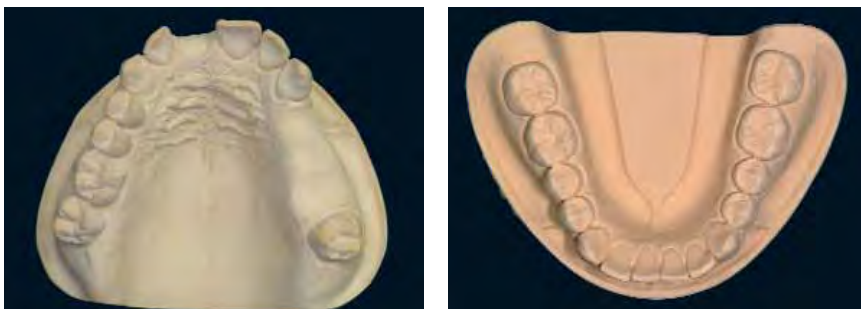
Once the clinical and radiographic examinations have been conducted to determine possible treatment methods, the planning of implant-retained prosthetic restorations can begin.

Modern implant prosthetics is planned in reverse order, also known as backward planning, which means the prosthetic superstructure represents the starting point.

The most ideal position of the superstructure is determined by means of a prior anatomical wax-up. In this way, the implant can be placed according to the functional and aesthetic aspects of the superstructure.

### Preoperative model

Preoperative models made of super-hard die stone must reproduce the fine details of the occlusal surfaces, gingivo-buccal fold, and retromolar areas. The impression of the entire jaw situation helps to identify and take into consideration any augmentations required. Skull-related, articulated preoperative models are the prerequisites of model analysis. With the help of the cast model analysis and a diagnostic wax-up, the implant-retained prosthetic restoration can be planned.



### Diagnostic Wax-up

A diagnostic wax-up of the missing tooth and jaw records should precede every prosthetic restoration. With the help of an anatomical wax-up, the optimum functional and aesthetic tooth position can be planned. Atrophied jaw bones can be recognized and augmentative measures for an implant-retained prosthetic restoration diagnosed in time.



**Planning template**

To determine the planned implant position in the jaw, a planning template is fabricated, which subsequently can be extended to become a radiographic and drill template.

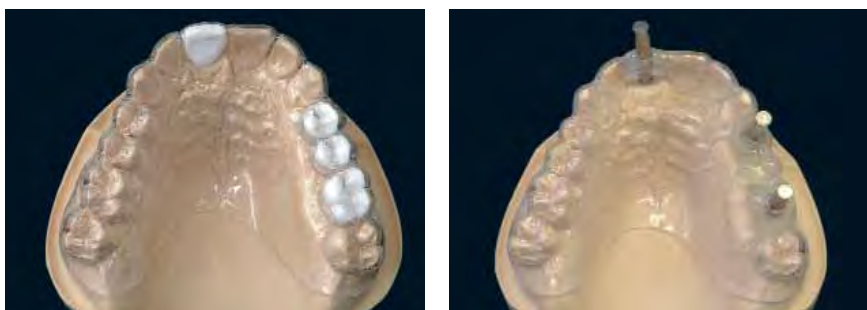
After the fabrication of the diagnostic wax-up, a silicone matrix is made, which is divided orally to the central occlusion line. This results in a vestibular and an oral part. With the help of these silicone keys, a planning template can be fabricated. The templates are fabricated using a vacuum-forming procedure or with cold- or hot-curing polymer.



SR VivoTAC/SR OrthoTAC

**Radiographic template**

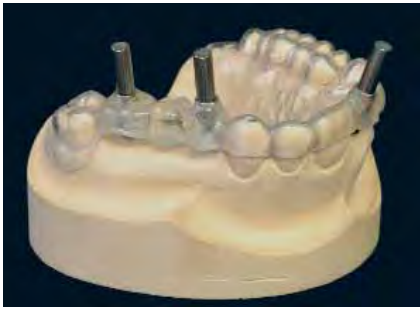
Radiographs provide information about the bone structure available for the implantation and about the position of the important anatomical landmarks. The planning template can be used as the basis. CT tubes or other radiopaque markers, such as radiopaque teeth, are placed in the ideal implant positions, which are then used as reference positions in the radiographs. With the help of computer tomography, it is possible to obtain a sectional radiograph of the bone in certain areas of the jaw. The medical information obtained with the radiographic template is subsequently used to determine the implant positions, number of implants, implant diameters, and implant lengths, always taking the corresponding enlargement factor into account.



Radiograph of the implant restoration on molar 26

**Drill template**

Drill templates facilitate the placement of the implants according to prosthetic aspects during the surgical procedure. With the drill template, the planned location and axial position of the implant is transferred to the bone. At the planned implant insertion location, a guiding hole is drilled into the resin or titanium tubes inserted in the corresponding axial direction. The surgeon uses the drill template to conduct the pilot drilling. Adequate stability and fixation of the template in the dental or gingival area is required. The radiographic template can also be used as drill template after the corresponding adaptation.





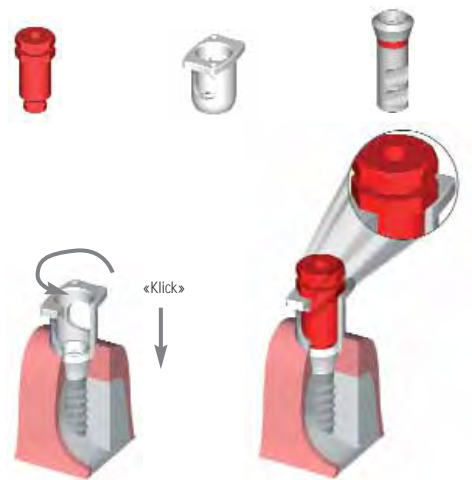
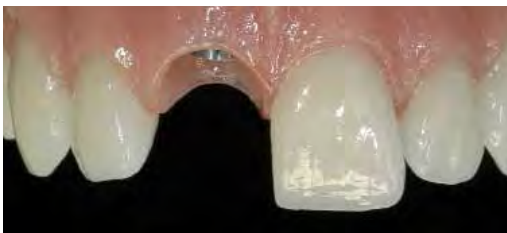
## Impression taking methods

The objective of impression taking is the exact reproduction of oral situation including the implant position and the corresponding dimensions.

Different impression taking methods may be applied depending on the individual requirements:

### – Closed-tray impression

The locked version represents an easy impression taking and model fabrication method. The closed-tray impression method can be used for both individual implants and groups of inserted implants. A coded impression cap is placed either directly on the implant or the screwed down impression post and the impression is taken using a closed impression tray.



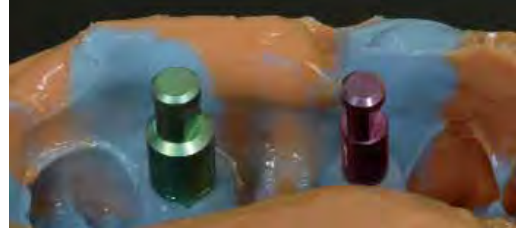
RN synOcta® Transfer System (Institut Straumann AG)



Impression cap, impression post (Camlog Biotechnologies AG)



After impression taking, the model implant is inserted into the impression elements. The impression post and model implant must perceptibly click into place in the impression elements.



### – Open-tray impression

The screwed version is suitable for both individual implants and groups of inserted implants. It is particularly indicated for non-parallel inserted implants and with very deeply located implant shoulders or if the gingiva is flush with the implant. The sturdy and precise screw connection between the impression post and the implant prevents the impression posts from coming loose.



Impression post (Camlog Biotechnologies AG)



RN synOcta® impression cap, model implant (Institut Straumann AG)

During impression taking, the impression post is firmly screwed to the implant. After loosening the screw, the impression with the integrated impression post can be removed.



Light Tray



For model fabrication, the model implant is firmly screwed to the impression post. While the screw is being tightened, the model implant must be held at its retentive part. The impression is taken using a custom-fabricated, open impression tray.

– Direct impression of a post

Impression taking and model fabrication method same as the one used in the crown and bridge technique.

**Important:**

The impression caps and impression posts must be precisely inserted or screwed into the implants/model implants.



(Camlog Biotechnologies AG)

**TIP:**

The model implants required for model fabrication should be available in the laboratory together with the impression.



The instructions of the implant system manufacturer must be strictly observed.

## Bite registration

For the three-dimensional determination of the relation between the mandible and the maxilla (centric relation), a maxillo-mandibular relationship record (bite registration) is prepared. The maxillomandibular relationship record is fabricated in the same way as in the crown and bridge technique. Various bite registration auxiliaries are provided by the implant manufacturers to facilitate the preparation of the maxillomandibular relationship record. These auxiliaries are clicked into place directly on the implant or on the impression post.



Caps for the bite registration  
(Camlog Biotechnologies AG)

The actual bite registration can be performed with the usual materials. The auxiliaries are repositioned on the model implants, the bite registration mounted, and the maxillary and mandibular models articulated in an adjustable articulator according to average values.



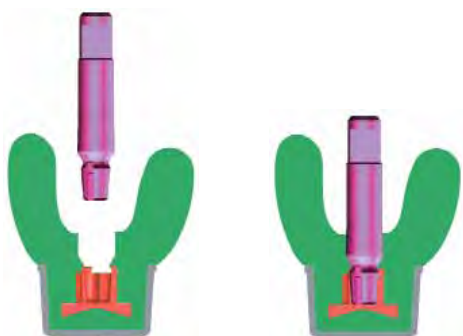
## Model fabrication

Precise model fabrication is the basic prerequisite of every prosthetic restoration.

The correct processing of the materials used during impression taking in the clinic and model fabrication in the laboratory is absolutely necessary.

Only with the coordinated cooperation between clinic and laboratory can the zero position of the implants be achieved. The zero position is three-dimensional and defines the exact position of the implants in the oral cavity of the patient.

Depending on the implant system and impression taking method, the model implants are manually set into the impression of the firmly positioned impression caps or impression posts. With a screwed down impression, the screw of the model implant must be held at the retentive part during manual tightening.



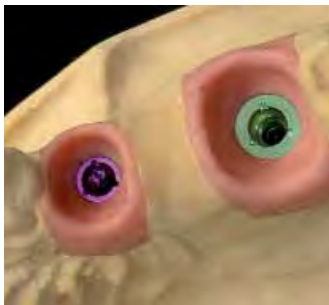
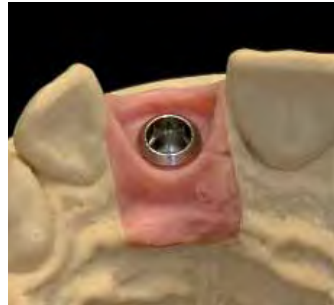
Impression post with model implant: closed-tray impression  
(Camlog Biotechnologies AG)



Impression post with model implant: open-tray impression  
(Camlog Biotechnologies AG)

**Prerequisites for exact and reproducible results for impression taking and model fabrication:**

- All the materials used for impression taking and model fabrication have to be processed according to the manufacturer's instructions (each deviation may lead to uncontrollable results)
- The impression taking time in the clinic should be noted (important for the calculation of the setting time of the impression material)
- The time required for the elastic recovery of the impression material indicated by the manufacturer must be observed (particularly important in conjunction with exposed jaws and diverging impression posts)
- Cleaning and disinfection of the impression
- Exact positioning of the model implants and transfer elements
- Selection of the model system and model fabrication method
- The expansion of the stone must be taken into account (constant expansion of the special stone should be below 0.08 %)
- While the type 4 special stone is vibrated, it must be ensured that the transfer elements are not turned loose



**Important:**

The model implants must be precisely inserted into the impression caps and impression posts and perceptibly snap into place or be screwed down. An adhesive must not be used. Model implants may only be used once.



(Camlog Biotechnologies AG)

## Gingival (soft tissue) mask

For the optimum design of implant-retained crown and bridge restorations, a removable gingival mask should be fabricated on the master model. Silicone materials in various consistencies and different shades of pink are available for the fabrication of gingival masks.

Advantages of a gingival mask:

- unimpeded view of the model implants
- check of the accuracy of fit of the superstructures
- precise reproduction of the gingiva (gingival mask is removable)
- precise reproduction of the gingival margins (emergence profile)
- design of the prosthetic restoration according to the gingival outlines
- fabrication of superstructures that are convenient to clean from a periodontal standpoint

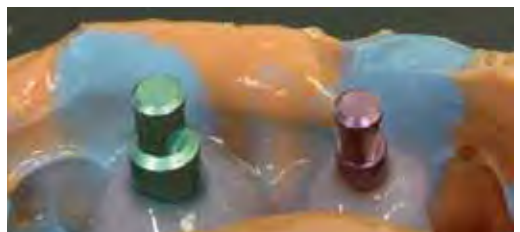


**Gingival masks can be fabricated directly or indirectly:**

### Direct fabrication

Once the impression has been taken, the gingival mask is fabricated directly in the impression.

- Before the silicone material is injected into the impression, a recommended separating agent should be used
- Apply silicone walls as a limiter for the gingival mask
- The silicone material is directly injected/poured into the impression around the model implants
- After the silicone material has set, the removable gingival mask is adjusted by grinding to give it a conical shape for the subsequent model fabrication





### Indirect fabrication

After pouring the master model, the gingival portion made of die stone is replaced with a removable gingival mask made of a silicone.

- A silicone key is prepared with the screwed down impression posts.
- The gingival area made of stone is generously reduced by grinding to below the upper part of the model implants.
- The silicone material is poured or injected through the pre-drilled injection channels in the silicone key.
- Subsequently, the gingival mask is carefully adjusted.



#### TIPS:

- Make sure that the removable gingival mask demonstrates adequate stability to ensure easy removal from and exact repositioning on the master model.
- For the indirect fabrication, the neck areas of the model implants may be slightly blocked out with wax at the gingival edge before the silicone material is applied.



**Gingival masks are elastic and difficult to adjust by grinding. In order to prevent inaccuracies in the area of the pontics, these areas may be left out and designed of stone as a rigid, grindable pontic rest.**



## Gingiva former

Gingiva formers are used for the controlled healing of the peri-implant mucous membrane. In this way, the aesthetic starting position of the implant-retained restoration can be substantially improved.

Gingiva formers are usually prefabricated. However, they may also be individually created.



### **Fabrication of an customized gingiva former / healing cap in the laboratory**

For the fabrication of an individualized gingiva former, complete modelling of the crown is required. The precisely contoured crown is reduced far above the gingival margin and may thus optimally support controlled healing. The fabrication procedure and the marginal accuracy are of utmost importance. The gingiva former is fabricated of a biocompatible alloy and may be adequately reduced vertically after try-in. The necessary wear period in the oral cavity of the gingiva former that has been polished to a high gloss is approximately 20 to 30 days.

## Temporary restorations

### SR Ivocron PMMA

With implant-retained prosthetic restorations, a variably long clinical healing phase must be expected. During this time, the patient should be provided with the best possible temporary restoration. Furthermore, the temporary is used for the planning of the subsequent implant-retained restoration.



Temporaries may be individually fabricated directly in the clinic or in the dental laboratory. The fabrication procedure for the temporaries is the same as that used in the crown and bridge technique. Temporaries may be fixed or removable and they are classified into short- and long-term temporaries on the basis of the intended wear period.

To facilitate the fabrication of the temporaries, a previous wax-up or prefabricated, ground denture teeth can be used.

During the fabrication of implant-retained prosthetic restorations, temporaries may be used for soft tissue shaping (emergence profile). The resin temporaries may contribute to the forming of the emergence profile through continuous build-up in the gingival area.





Aesthetic problems with implant restorations may result from the implant diameter, which does not always correspond with the emergence profile of the tooth to be replaced. The emergence profile can be advantageously shaped using prefabricated and custom-fabricated gingiva formers or customized temporaries.

Implant manufacturers offer various prefabricated temporary abutments made of resin or metal. Aesthetically similar to the final superstructure, they may be veneered with resin, even though they should be fabricated without occlusal contacts during the healing phase.



Temporary abutment PEEK  
(Camlog Biotechnologies AG)

RN synOcta®  
construction for temporization  
(Institut Straumann AG)

**TIP:**

Long-term temporary bridge restorations should be made of resin with metal reinforcements.

**Important:**

No occlusal force may be transmitted to the healing implant by way of the temporary. Temporaries must be positioned free of tension and should provide adequate support of the soft tissues.

# Implant-retained prosthetic superstructures

The function and aesthetics of the overall restoration are significantly influenced by the position and diameter of the inserted implants. The location and position of the replacement teeth should correspond to those of the natural teeth to the highest possible extent. The planned superstructure should not be exclusively designed according to the inserted implant. Functional, aesthetic, and phonetic aspects, as well as the intended ease of periodontal hygiene also determine the position of the superstructure.

Prefabricated abutments and auxiliary elements, together with custom-fabricated mesostructures/abutments, have to be selected and processed with the best possible knowledge and utmost skill. Once all the clinical and prosthetic preparations have been completed, the fabrication of the permanent implant-retained restoration may be commenced in the dental laboratory.

## Abutment

The abutment/implant post is the load-bearing connection element between the implant and the superstructure.

## Abutment selection

The selection of the suitable abutments is done in the laboratory since the impression only records the implant position. The intended superstructure ultimately determines the selection of the abutments. With the help of the fabricated silicone matrix of the anatomical wax-up, the abutments are selected in a goal-oriented manner.



## Abutment selection aids

To facilitate the selection of the abutments, the implant manufacturers offer a number of plastic abutments. These planning auxiliaries are positioned on the model implant in the model. The height, axial direction, and screw axis can be checked and the optimally fitting secondary elements/abutments selected.



(Camlog Biotechnologies AG)



(Institut Straumann AG)

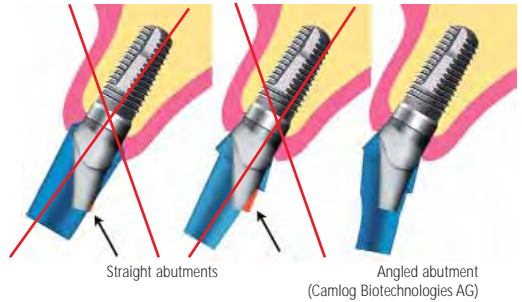
## Important:

The plastic abutments/plastic secondary elements must not be clinically used.

**Important information regarding abutment selection**

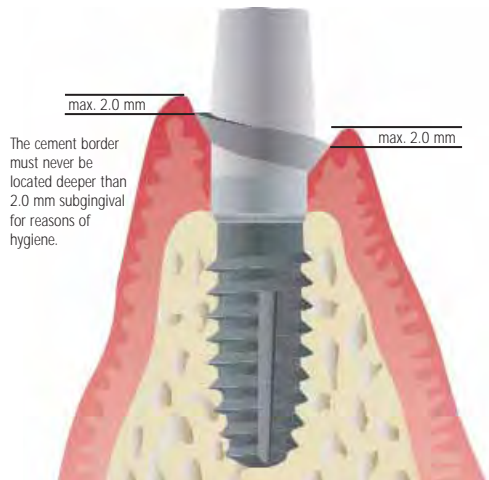
**– Implant axis**

Straight abutments may balance out an axial inclination. With a more pronounced axial inclination, however, angled abutments of 15° or 20° must be used or custom-fabricated as mesostructure. Angled or custom-fabricated abutments may compensate for unfavourable directions of the implants.



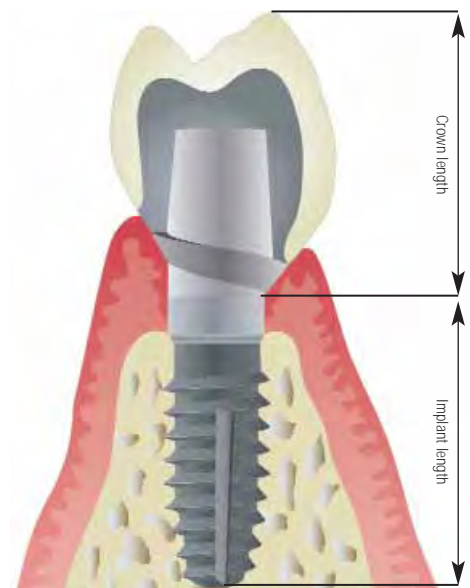
**– Height of the gingiva**

The maximum thickness of the proximal mucous membrane determines the height of the gingiva. The stipulated abutment/gingival height corresponds with the height at the deepest labial/buccal point. For aesthetic reasons, permanent crown margins should be located subgingivally. For reasons of hygiene, the crown margin should not be located more than 2 mm below the gingiva. A suitable pre-fabricated abutment is selected in accordance with the height of the gingiva. If necessary it has to be modified or fabricated as an individual meso-structure.



**– Vertical dimensions**

Abutments must be correctly selected with regard to their implant length relative to the occlusal plane. Depending on the available space and taking the occlusal plane into consideration, abutments may be shortened. With a correct length relation, the super-structure should be smaller than the implant. If the length relation is such that the super-structure is longer than the implant, super-structures can be interlocked. The implant type must be taken into consideration and the stipulations of the implant manufacturer carefully observed.



## Difference between prefabricated and custom-fabricated abutments

### – Prefabricated abutments

They are made of titanium or zirconium oxide. Given the different gingiva penetration heights, different abutments are available, which can be customized.

#### *Titanium abutment:*

- gingiva height 1.5 mm or 4 mm
- straight or 15°/20° angled abutments
- anatomical shoulder
- massive abutments and cylinders without shoulder

#### *Zirconium oxide abutment:*

- zirconium oxide abutment that can be customized



(Camlog Biotechnologies AG)

### – CAD/CAM-fabricated abutments

They are made of titanium or zirconium oxide.

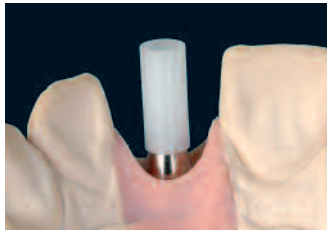
- CAD/CAM-fabricated zirconium oxide abutments may only be processed according to the instructions of the manufacturers.



### – Custom-fabricated abutments

They are made of a precious metal alloy capable of being cast on and resin.

- Gold-resin abutments, capable of being cast on
- Gold copings, capable of being cast on
- Resin copings, capable of being burned out



**There are various auxiliaries, such as abutment holders, for the customization of the abutments.**

## Differences between screw-retained, cemented, or adhesively luted superstructures on rigid abutments.

### – Screw-retained

Superstructures may be vertically or horizontally screwed down.



### – Cemented or adhesively luted

Superstructures are cemented or adhesively luted on a rigid abutment according to the manufacturer's instructions.




### **Important:**

The processing parameters stipulated by the implant manufacturer must be strictly observed during the fabrication of implant superstructures.

## Advantages and disadvantages of screw-retained and cemented superstructures

Screw-retained superstructure	
Advantages	Disadvantages
<ul style="list-style-type: none"> <li>- Removable</li> <li>- Screws are accessible in case of repair</li> </ul>	<ul style="list-style-type: none"> <li>- Bacteria accumulation in the gap areas</li> <li>- Suboptimal occlusal surface design</li> <li>- Unsatisfactory aesthetics</li> <li>- Transocclusal screws:                             <ul style="list-style-type: none"> <li>- More dental-lab work required</li> <li>- More components required</li> <li>- Difficult accessibility in the oral cavity</li> <li>- Treatment more time consuming</li> <li>- Higher costs</li> </ul> </li> </ul>

Cemented superstructure	
Advantages	Disadvantages
<ul style="list-style-type: none"> <li>- Sealed gap areas</li> <li>- Easy handling in the oral cavity</li> <li>- Ideal design of the occlusal surface</li> <li>- Better aesthetic appearance</li> <li>- Treatment less time-consuming</li> <li>- Fabrication less time-consuming</li> <li>- Less components</li> <li>- Lower costs</li> <li>- Even distribution of tension and loads</li> </ul>	<ul style="list-style-type: none"> <li>- Excess cement difficult to remove</li> <li>- Periimplantitis possible</li> <li>- Possible damage of the superstructure required if screws turn loose or the ceramic fractures</li> </ul>

(Source Dr. R. Wilsch)



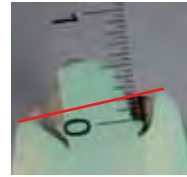
## Abutment preparation

For the fabrication of implant-retained superstructures, the abutments have to be prepared like the natural tooth cores. The different prefabricated abutments may be customized.

The vertical height is checked with the help of the silicone key of the wax-up and marked. The axial orientation should be checked using a parallelometer and subsequently adjusted, if required, by means of a milling device.

**The correct individualization of the abutment is checked by means of a silicone key:**

- vertical dimension
- circumference
- preparation angle 2°–4°
- chamfer preparation
- course of the preparation margin (cement border)
  - subgingival location in the vestibular area (recommendation)
  - paragingival location in the oral area (recommendation)
- Cement borders should not be located more than 2 mm subgingival



### Customizable titanium abutments

The titanium abutment is adjusted to the desired dimensions using a titanium or tungsten carbide metal bur. The titanium abutments should not be given a completely round shape, since this may result in a rotation of the framework. Slightly flat areas and ground in grooves contribute to an anti-rotation lock, particularly in single-tooth restorations.

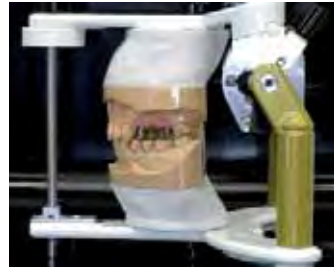
#### **Important:**

Heat development during titanium grinding must be prevented. Use only limited pressure and prevent overheating. Maximum speed: 10,000 rpm.

During the customization procedure, the titanium abutment should be replaced on the master model several times and checked in the articulator as well as with the silicone key.



The titanium abutment is customized in such a way that there is ample space for the superstructure. Once the dimensions have been determined, as well as checked in the articulator with the help of the silicone key, the titanium abutment is finally finished with a rubber polisher. High-gloss polishing is only carried out in the area of the gingiva. The part of the titanium abutment to be used for the cementation of the superstructure remains unpolished.



**Implant manufacturers offer various universal holders to facilitate the processing of titanium abutments.**

- **Camlog Biotechnologies AG:**  
The abutment is mounted in the abutment holder, which corresponds to the abutment diameter, by means of the retaining screw and secured in the universal holder with a hex screwdriver.
- **Institut Straumann AG:**  
The abutment is screwed to the manipulation implant and simply clamped in the handle for manipulation implants by means of the split chuck.



(Camlog Biotechnologies AG)

**TIP:**

For even better aesthetics in the marginal area, an individually fabricated gold abutment may be reduced in the marginal area and veneered with suitable shoulder materials according to the emergence profile. The cement border must be observed during this process.

**Customizable zirconium oxide abutments**

The same preparation parameters apply for the preparation of customizable zirconium oxide abutments. However, only grinding instruments recommended by the respective manufacturer may be used, as well as a water-cooled turbine.



(Camlog Biotechnologies AG)

# Fabrication of superstructures

## *for single-tooth restorations and bridges*

The fabrication of different implant-retained prosthetic restorations is described by means of several examples of fabricated superstructures.



### Implant-retained single-tooth restorations

- Secondary element/gold-plastic abutment, capable of being cast on, alloy framework, metal-ceramic veneer, conventional cementation
- Gold coping, capable of being cast on, metal-ceramic veneer, horizontally screwed down
- Customized zirconium oxide abutment, CAD/CAM-fabricated, press technique, all-ceramic veneer, adhesive cementation



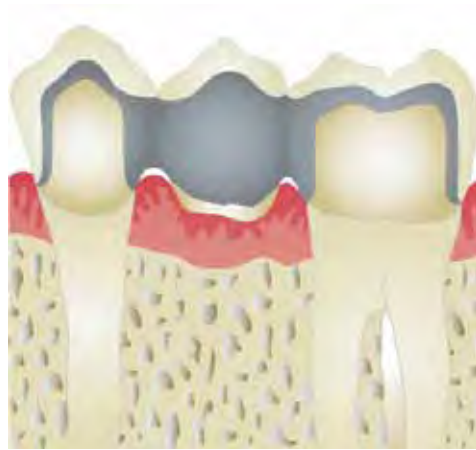
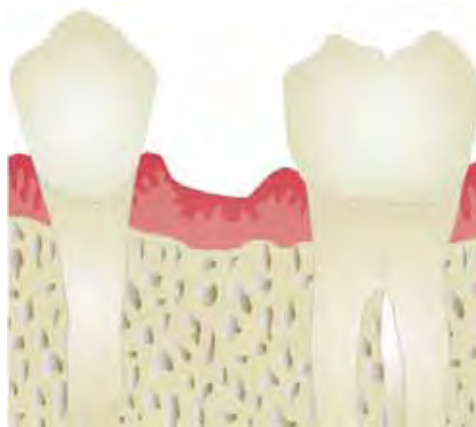
### Implant-retained bridges

- Titanium abutment, alloy framework, metal-ceramic veneer, conventional cementation
- Titanium abutment, alloy framework, metal-ceramic veneer, horizontally screwed down
- Titanium abutment, zirconium oxide framework, CAD-CAM fabricated, press technique, all-ceramic veneer, conventional cementation (or adhesive cementation)



# Implant-retained single-tooth restorations

The use of single-tooth implants represents a particularly reliable therapy option in a single gap situation. One of the decisive advantages over the conventional bridge technique is that no adjacent teeth have to be prepared as abutments. Superstructures on single implants have to feature an anti-rotation lock.



Implant products from Institut Straumann AG were used in the fabrication of the single-tooth restoration. The processing instructions of the manufacturer, i.e. Institut Straumann AG, have to be strictly observed.

# Metal-supported

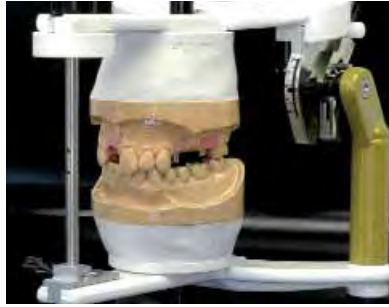
Gold-plastic abutment, capable of being cast on, alloy framework, metal-ceramic veneer, conventional cementation

Gold coping, capable of being cast on, metal-ceramic veneer, horizontally screw-retained

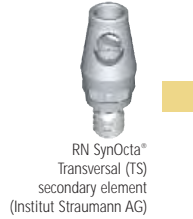
## Individual mesostructures (abutment / secondary element)

### Callisto® Implant 78 alloy

Completely prepared master model with gingival mask articulated according to average values.



The prefabricated secondary and tertiary elements are exactly positioned on the model implant and tightened with a screw.



The secondary element is capable of being cast on and consists of a non-oxidizing high gold alloy and a plastic tube that can be burned out (modelling auxiliary).

Gold copings capable of being cast on, as well as plastic caps that can be burned out without leaving residue with a threaded tube capable of being cast on are available for transversely screwed down tertiary elements.

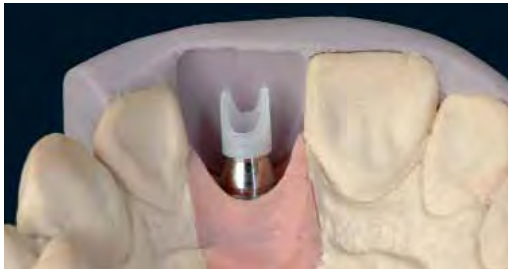


RN SynOcta® secondary gold element (Institut Straumann AG)



RN SynOcta® TS gold coping, transverse (TS) secondary element (Institut Straumann AG)

- The plastic tube is shortened in accordance with the vertical and lingual space situation. The plastic tube should be mounted on the secondary element capable of being cast on by means of modelling resin.



- The gold coping for the cast-on technique is screwed down on the model implant and the framework is waxed-up. The framework is given a reduced anatomical shape and checked by means of the silicone key.



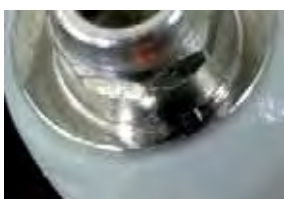
- Once the fully anatomical wax-up has been completed and a silicone key fabricated, the individual secondary element is contoured in wax. If a modelling resin is used, the plastic part has to be coated with a wax layer of at least 0.3 mm. The hollow space created by the wax, which is burned out first, serves as a freeway space for the expanding resin and prevents the investment material from being detrimentally affected during pre-heating.



- Towards the metal edge and the metal surrounding the threaded area, the contouring should be somewhat more pronounced. Exact contouring, however, is required towards the gold coping. In the area of the non-oxidizing tertiary alloy element capable of being cast on, an alloy margin should be maintained. Since the gold coping does not form any bonding oxides, the metal-ceramic material may only be applied on the cast on alloy areas.



- The individual secondary element is now soundly contoured up to the delicate metal edge and the available space checked by means of the silicone key. The wax or resin-wax layer should be at least 0.7 mm thick. In order to ensure a clean cast-on procedure, the contouring should be somewhat thicker towards the metal margin. Furthermore, cooling structures are applied in this thicker marginal area. The delicate metal margin must remain free of grease and wax and should be checked under the stereo microscope.



and wax and should be checked under the stereo microscope.

- Before investment, a thread protection screw is screwed into the gold coping. In order to be able to remove the thread protection screw more easily after casting, the thread should be coated with graphite beforehand.

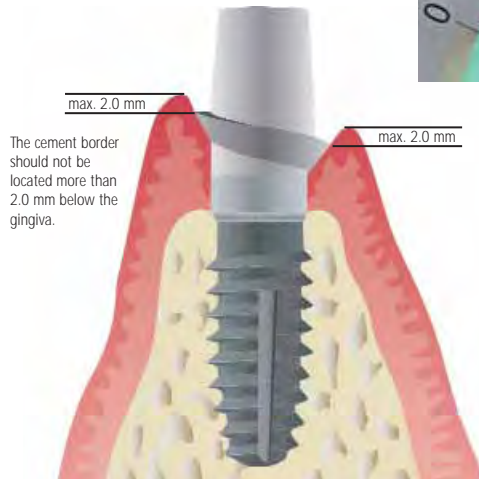




**TIP:**

To facilitate the handling and contouring away from the model, the use of an additional model implant is recommended.

The gingival area must be designed in accordance with the emergence profile and the cement border. For aesthetic reasons, the cement border should be located in the subgingival area, but should not be more than 2.0 mm subgingival for reasons of oral hygiene.



The individual secondary elements are provided with a sufficiently large sprue or a casting pear (sprueing method according to the casting system used). The dimensions of the reservoir, which is placed in the heat center, must be larger than those of the wax object. The object to be cast should not be located too close to the investment ring margin, since this may result in any cast-on objects to cool prematurely.



**Important:**

- Do not use a debubbler (latent heat)
- Clean the visible part of the secondary element capable of being cast on using a brush or cotton swab soaked with alcohol to prevent the alloy from spilling onto the secondary element capable of being cast on.
- The other areas of the wax-up should not come into contact with alcohol, since the resulting latent heat may lead to distortion
- If cast-on elements, such as gold-plastic abutments, and modelling resin are used, speed investment materials are not recommended (slow heat-up of the cast-on elements and the possible expansion of the resins have to be taken into consideration).



The application of cooling structures removes heat energy from the casting object and prevents the covalent lattice structure of the mixed materials from changing.



The object is invested with a phosphate-bonded investment material. The instructions of the manufacturer regarding the mixing ratio and pre-heating times have to be observed. The secondary element capable of being cast-on is conventionally pre-heated according to the manufacturer's instructions.



**TIP:**

Especially with gold abutments capable of being cast-on, the pre-heating temperature should be increased by 50 °C (122 °F) and the holding time at the final temperature prolonged by at least 30 minutes.

In order to prevent the alloy from spilling into the inner aspects of the gold abutment, the instructions for use of the implant, alloy, and investment material manufacturers have to be carefully observed.



The selected cast-on alloy has to be compatible with the high-fusing alloy of the secondary element. The melting range of the cast-on alloy must not exceed the liquidus temperature of 1350 °C (2462 °F) (see alloy overview for implant superstructures on page 68).

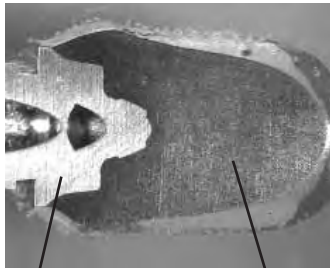




After casting the individual mesostructures/tertiary elements and the slow cooling of the investment ring to room temperature, the cast object can be carefully divested. The area of the cast-on secondary element must never be blasted using aluminium oxide. Fine divesting is carried out with ultrasound, the steam jet, or by pickling.

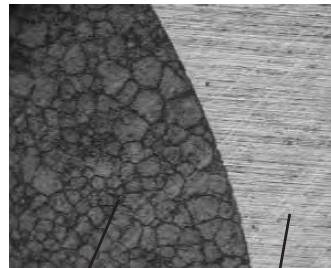


Light microscopic images of the cast gold elements at 10- and 200-fold enlargement.



Gold abutment

Cast-on alloy



Cast-on alloy

Gold abutment



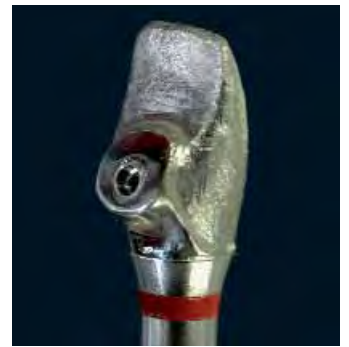
A good accuracy of fit can only be ensured by gentle treatment of the surface in the area between the abutment and the implant. The inner aspect of the abutment should be exactly as smooth and shiny as before investing it.



**Important:**

The examination of the cast object reveals whether or not all the areas have been completely cast. If casting errors are evident, such as incomplete casting, casting beads, casting flash, or spilling of the alloy into the inner aspect, the fabrication of the mesostructure must be repeated.

The mesostructures are fitted on the model and adjusted with suitable tungsten carbide metal burs. The silicone key is once again used to check the space conditions. The final cement border must now be determined.



After finishing, the individually fabricated mesostructures are manually screwed onto the model implant.



**Important:**

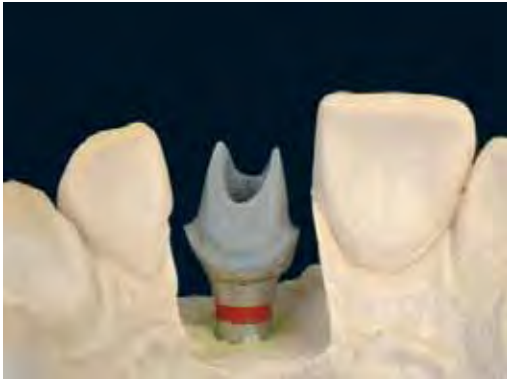
If a superstructure for direct metal-ceramic veneering is indicated, the cast-on alloy must not be ground or exposed in the area of the metal-ceramic veneer. Exposed areas of the non-oxidizing alloy cannot be veneered with ceramic materials, since the different coefficients of thermal expansion may lead to cracks and tears. After finishing, the framework must still be covered with at least 0.3 mm of the cast-on alloy.



## Frameworks for cemented superstructures

### IPS d.SIGN® 98 alloy

The screw cavity is blocked out with wax or resin. The framework is shaped to reduced anatomic contour with the help of the silicone key. The recommendations regarding framework design for metal-ceramic restorations must be observed. The thickness of single-tooth frameworks must be at least 0.3 mm after finishing.



Once the margin has been examined under the stereo microscope, the framework is invested and cast in the usual manner.



After divesting, the framework is fitted onto the model and finished using tungsten carbide metal burs. Work only in one direction to prevent overlapping. A circular metal margin is maintained.



## Metal-ceramic veneer

### IPS InLine® leucite metal-ceramic

The frameworks are thoroughly cleaned using the recommended aluminium oxide and prepared for oxidation.



Once an even oxidized surface has been achieved, opaquer application may commence.

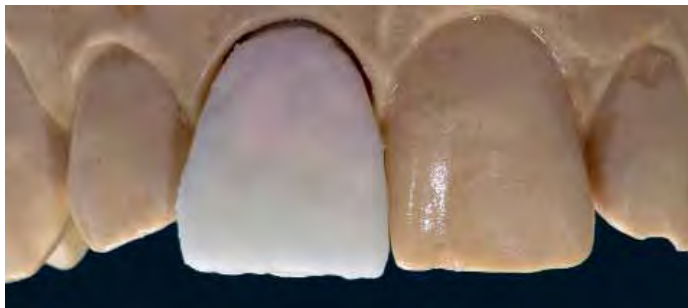
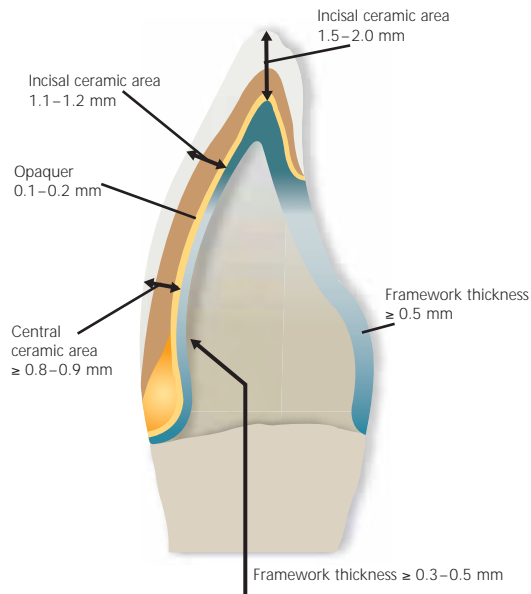


The only slightly covering wash layer permits renewed gas evolution from the alloy. For the second opaquer firing, a thin opaquer layer is applied which should evenly cover the entire framework.





The superstructures may now be individually veneered using metal-ceramic veneering materials and finished. The veneering material layers should measure min. 0.8 mm and max. 2.0 mm. In the anterior area in particular, the best possible aesthetic shape and shade design needs to be achieved.



After the final adjustment of the anatomical shape and the ceramic surface texture, the stain and glaze firing is conducted.



Finally, the accuracy of fit, functional occlusion, shade, and possibility of oral hygiene of the metal-ceramic superstructures are thoroughly checked.



The completed, veneered metal-ceramic superstructures on individually fabricated secondary and tertiary elements.







The high gold alloys IPS d.SIGN 98 and Callisto Implant 78, as well as the IPS InLine metal-ceramic veneering material were used for the fabrication of the superstructures. The processing instructions of the manufacturer Ivoclar Vivadent must be carefully observed.

## Transfer aids

In order to transfer the correct position of the secondary elements from the model to the patient, prefabricated or custom-fabricated plastic transfer aids may be used, depending on the implant manufacturer. The prefabricated transfer aids are put on and secured on the model using modelling resin. The occlusal screw cavity must always remain unobstructed. For single-tooth crowns, the position is ensured by means of the adjacent teeth, while the secondary elements are interlocked for bridge restorations.



Transfer aids for  
RN synOcta® TS secondary element  
(Institut Straumann AG)



# All-ceramics

## Zirconium abutment / all-ceramics

Zirconium oxide abutments present themselves as a possibility for metal-free implant-retained restorations.

- Zirconium abutments are prefabricated and customized in the laboratory using the recommended grinding instruments and a water-cooled turbine.
- Customized zirconium oxide mesostructure, individually designed at the computer, and milled in a CAD/CAM unit.

Possibilities for all-ceramic superstructures:

- Press technique (IPS e.max Press, IPS e.max ZirPress, IPS Empress Esthetic)
- CAD/CAM technique (IPS e.max ZirCAD, IPS e.max CAD, IPS Empress CAD)
- Layering technique (IPS e.max Ceram) directly applied onto the zirconium oxide abutment or onto framework materials from the IPS e.max System

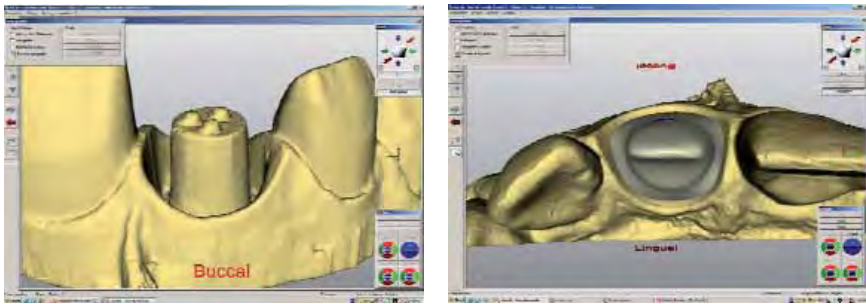


## Customized CAD/CAM zirconium oxide abutment, pressed ceramics, all-ceramic veneer, adhesive cementation

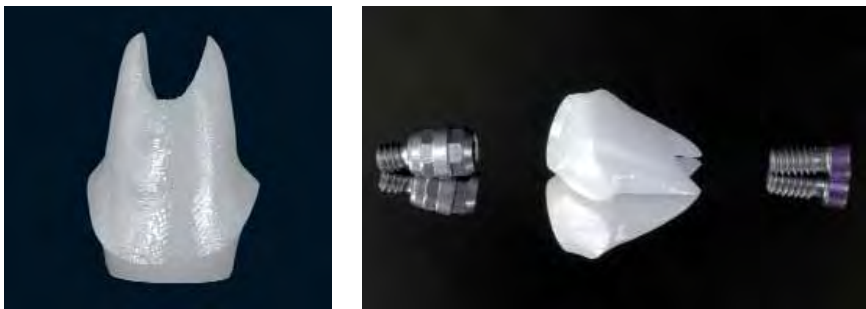
### Customized zirconium oxide mesostructure

Together with Sirona, Institut Straumann AG offers individualized abutments (Straumann® CARES, Computer Aided Restoration Service).

The recording of the implant position on the model and the design of the abutment shape at the computer are carried out in the dental laboratory. A duplicate of the master model is fabricated using scanning stone. In order to determine the exact implant position, a scanning object is inserted into the scanning model and digitally recorded by means of the inEos® or inLab® scanner.



With the 3-D abutment software, the abutment can be individually designed at the computer. The data for the final mesostructure are saved and sent to the Straumann milling center via the Straumann portal. The highly precise, custom-milled abutment (Straumann® CARES) is delivered within a few workdays after order placement.

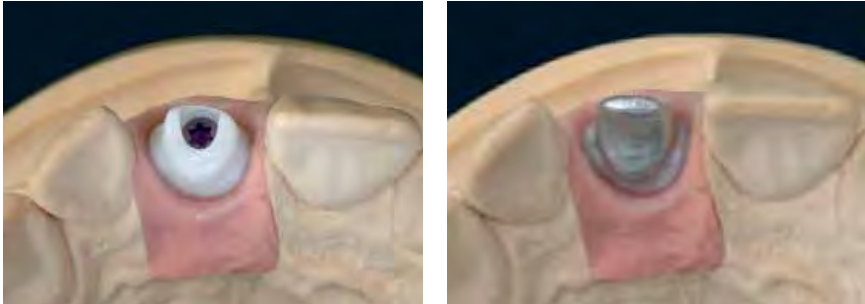


The customized zirconium mesostructure (Straumann® CARES) must not be adjusted by grinding (this may result in cracks and tears). The processing instructions of Institut Straumann AG have to be carefully observed.

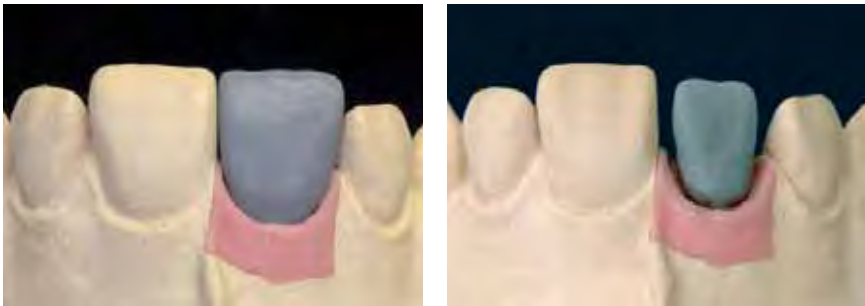
**Pressed ceramic, all-ceramic veneer, adhesive cementation**

**IPS e.max® Press – Lithium disilicate ingot /  
IPS e.max® Ceram – nano-fluorapatite glass-ceramic**

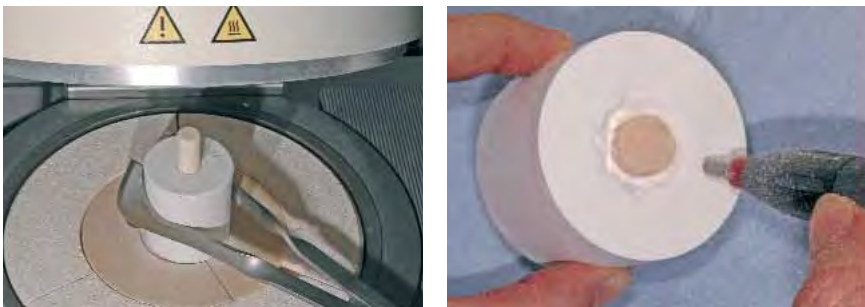
Before the framework is contoured, the vertical screw cavity is blocked out with composite and die spacer is applied.



With the help of the silicone key, the superstructure is completely contoured and then reduced to create space for the layering ceramic.



Sprueing, investing, pre-heating, and pressing are carried out according the stipulations in the instructions for use. After the investment ring has cooled to room temperature, the object is carefully divested. The investment ring is cut around the pressed object using a separating disk. Rough divestment is carried out with polishing jet medium at 4 bar pressure.



After fine divestment by means of polishing jet medium at 2 bar pressure, the reaction layer is removed using IPS e.max Press Invex Liquid. Then, the restoration is blasted with type 100 aluminium oxide at 1–2 bar pressure.



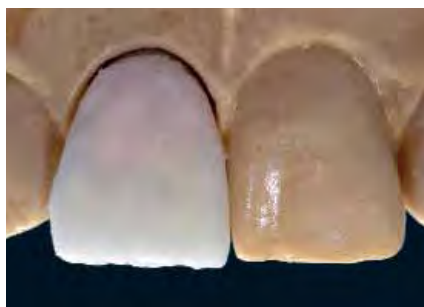
Fitting and finishing are conducted at low speed using the recommended grinding instruments. Finally, the framework onto which ceramic has been pressed is blasted with aluminium oxide at 1 bar pressure and subsequently cleaned using the steam jet.



The wash is applied on the clean, prepared all-ceramic framework and fired. Optionally, individual characterizations may be applied.



The dentin and incisal materials are layered in accordance with the layering diagram.





After the final adjustments of the anatomical shape and texture of the ceramic surface, the stain and glaze firing is conducted. Finally, the accuracy of fit, functional occlusion, shade, as well as the hygiene capability of the all-ceramic superstructure are thoroughly checked.



The completed, layered all-ceramic superstructure on a customized zirconium oxide abutment.



- For the fabrication of an all-ceramic superstructure, the shade design on the very light zirconium oxide abutment must be given particular attention right from the beginning.
- The pressed ceramic IPS e.max Press was used for the fabrication of the superstructure and IPS e.max Ceram for the all-ceramic veneer. The processing parameters of the manufacturer Ivoclar Vivadent must be carefully observed.



# Implant-retained bridges

## *Metal-supported*

The fabrication of bridge restorations on rigid implants requires high precision during the fabrication procedure. The tension-free (passive) fit of the superstructure is crucial for a homogeneous distribution of stress to the implants and the bridge.



The framework design parameters have to be carefully observed during the fabrication of implant-retained restorations. Uncontrolled transmission of force on the implants anchored in the bone must be avoided.

The use of framework materials of inadequate strength, as well as poor accuracy of fit of the superstructures may lead to both biological and technical failure.



**For the fabrication of the bridge restorations, implant products from Camlog Biotechnologies AG were used. The processing instructions of the manufacturer have to be carefully observed.**

## Superstructures

Callisto® Implant 78 alloy

Titanium abutments, alloy framework, metal-ceramic press technique, conventional cementation

Titanium abutments, alloy framework, metal-ceramic veneer, horizontally screw-retained



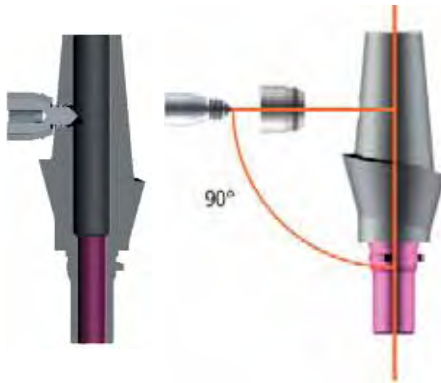
Before contouring the bridge, the parallelism of the abutments, and the parallelism of the abutments and the adjacent teeth, needs to be checked. The best option is to transfer their position to a milling base and then mill the abutments in parallel at the corresponding angle.



The unused screw cavities are blocked out using wax or resin prior to contouring.



A fully anatomical wax-up and a silicone key to check the available space should be fabricated at this point at the latest.



With a screw-retained superstructure, the overflow ring with the screw capable of being horizontally cast on is screwed into the thread of the abutment. The horizontal orientation of the screw is predetermined by the implant position and the selected abutment. The screw is oriented towards the vestibular and must be easily accessible intra-orally.



The overflow ring capable of being cast on is included in the wax-up of the framework and should not jeopardize the anatomical crown shape. The overflow ring can be freely contoured or included into the margin by designing a delicate rim.



**i** The screw must not be ground or treated in any other way, since this may result in the loss of the bearing surface for the hex screwdriver.

A framework cap with slightly enlarged dimensions is fabricated using modelling resin and placed on the abutment. Once the material has set, the cap is cautiously removed and adjusted by grinding to an even framework cap (a layer thickness of min. 0.3 mm should be maintained).



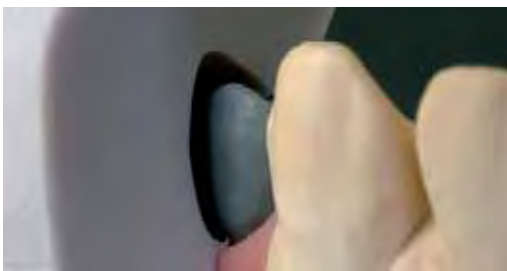
**TIP:**

The framework copings made of modelling resin are easier to remove from the titanium abutments after a waiting time of approximately 60 minutes.

A full wax-up and silicone key to check the available space for the ceramic material are then fabricated on the finished resin framework.

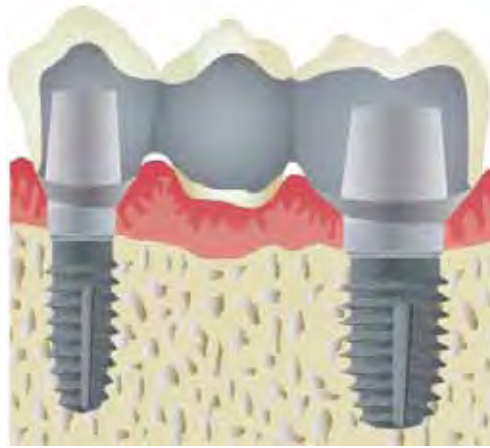


The subsequent cut-back of the full wax-up is carried out according to the general framework design guidelines (see "Framework Design for Metal-Ceramic Restorations" manual from Ivoclar Vivadent). It is absolutely imperative that the framework is designed to exhibit adequate strength and provide uniform support for the metal-ceramic veneer.



Elements contoured of modelling resin that can be burned out always have to be covered with a sufficiently thick wax layer (min. 0.3 mm). In this way, the expansion of the modelling resin can be controlled and a detrimental effect on the investment material can be prevented.

The oral hygiene-friendly design of the gingival area around the superstructure has to be taken into consideration as early as during framework design.



The final check of the margin should always be performed under the stereo microscope. A precise, tight margin is a must in implant prosthetics. In order to fabricate a stress-free wax-resin framework, it should be separated and reconnected (preferably with a very thin layer of modelling resin) before spruing.



The individual wax-resin framework is provided with adequate sprues or casting pears. Cooling structures are placed in the area of the pontics or very thick framework areas.





Special attention should be paid to a sufficiently large reservoir, which is placed in the heat center, when selecting the casting system. Only thorough knowledge of the materials and casting system used ensures the fabrication of precise and homogeneous frameworks.

The object is precisely invested using a phosphate-bonded investment material. The stipulations of the investment material manufacturer regarding the mixing ratio and pre-heating times have to be observed. The investment ring with the wax-resin framework is conventionally pre-heated according to the instructions of the manufacturer.

**Important:**

The solidifying behaviour is responsible for the exact accuracy of fit. Therefore, the expansion and contraction behaviour of the materials must be given special attention.

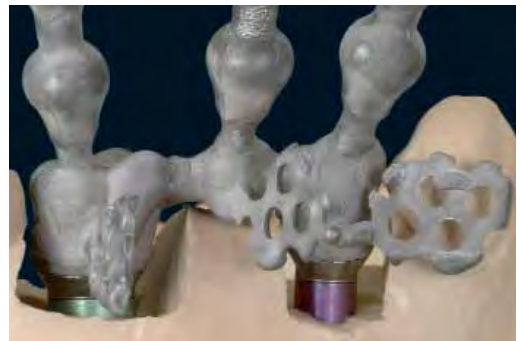
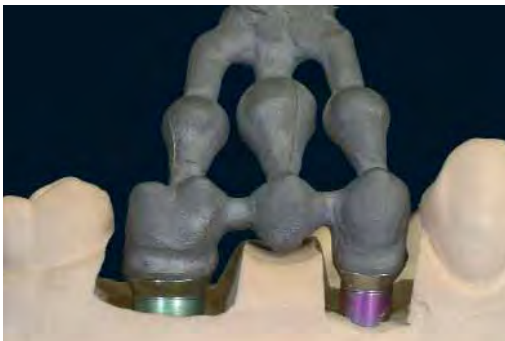


**For the fabrication of frameworks for implant-retained superstructures, only alloys with adequate physical strength values should be used:**

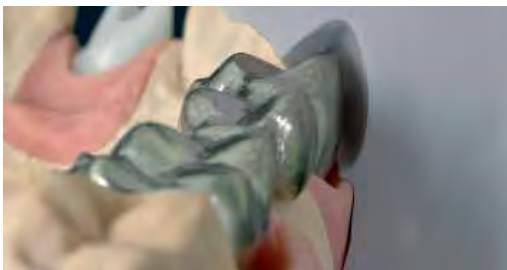
- 0.2 % proof stress at least 460 MPa
  - Elongation between 5 and 20 %
- (see alloy overview for implant superstructures on page 68).



After casting and slow cooling, the framework is carefully divested and blasted with aluminium oxide. The inner aspect must be treated very carefully in order to ensure the exact accuracy of fit of the frameworks on the abutments. If necessary, the accuracy of fit is checked and any interfering areas removed.



If the framework demonstrates a good accuracy of fit, the surface can be finished using tungsten carbide metal burs. For bridge restorations, the wall thickness of the framework should be at least 0.5 mm after finishing. In conjunction with implant-retained superstructures, the load-bearing framework with metal-ceramic veneer must feature torsion resistant strength.



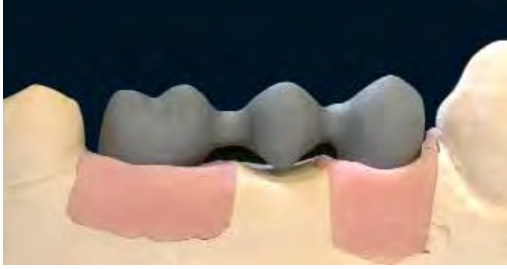
**i** Since no errors must occur during the fabrication of superstructures, the framework should be tried-in in the dental office before it is veneered with a metal-ceramic material. The rigid, bone-anchored implant-retained superstructures do not allow any tolerance.

The framework is checked in the articulator and by means of the silicone matrix as to whether sufficient space is available for an uniform metal-ceramic veneer. Following this, the framework is blasted with the recommended aluminium oxide and prepared for oxidation.

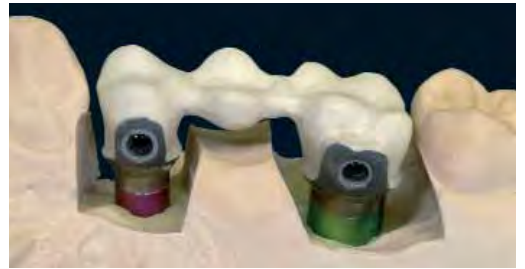
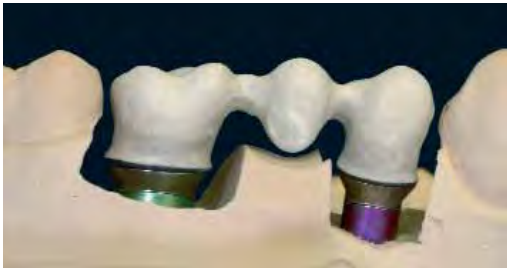




If an even oxidized surface has been achieved, the application of the opaquer may commence.



The only slightly covering wash layer permits renewed gas evolution from the alloy. For the second opaquer firing, a thin layer of opaquer is applied which should evenly cover the entire framework.

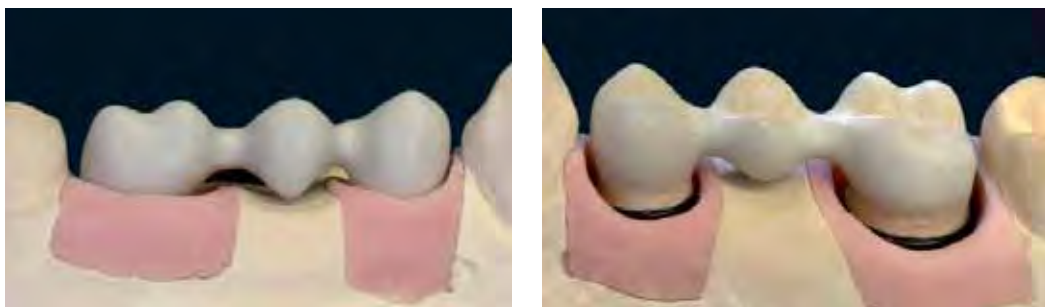


## Press and layering technique

IPS InLine® PoM – leucite glass-ceramic ingot /  
IPS InLine® – leucite metal-ceramic

### Metal-ceramic press technique (PoM – Press-on-Metal)

A ceramic ingot is pressed onto the superstructure. In the press technique, a wash firing, followed by a second opaquer firing, is conducted, just as it is done in the fabrication of metal-ceramic restorations.



The fully anatomical wax is fabricated on the opaquerized framework using wax that fires without leaving residue, since the framework is subsequently pressed to full contour. The completed wax-up is checked in the articulator and by means of the silicone key. The margins are thoroughly checked under the stereo microscope.



The superstructure waxed-up to full contour is weighed and the weight of the framework is subtracted. The superstructure is sprued according to the manufacturer's instructions. The framework to which ceramic will be pressed needs to be positioned in the stipulated area within the investment ring. The superstructure is carefully invested avoiding bubble formation. After the indicated setting time, it is then pre-heated in the pre-heating furnace at the stipulated pre-heating temperature. The size of the ceramic ingot is determined on the basis of the wax weight.

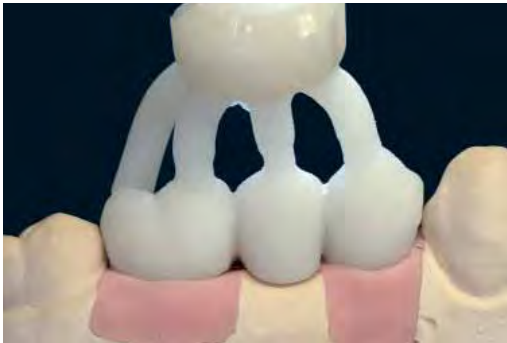


The CTE values of the alloy and the ceramic ingot must be coordinated with each other.

After the pressing procedure and slow cooling to room temperature, the investment ring is carefully divested. Once the investment ring is cut with a diamond wheel, the investment material is roughly blasted off with polishing jet medium (50  $\mu\text{m}$ ) at 4 bar pressure. In order not to damage the pressed objects, the pressure is then reduced to approximately 1–1.5 bar. Crown margins and inner aspects must always be blasted at an acute angle.



The superstructure is separated with a diamond wheel without overheating the ceramic material.



The accuracy of fit of the pressed-on superstructure on the abutments is checked and the proximal and occlusal contacts ground in.



**Metal-ceramic veneer, press technique, conventional cementation**

■ The add-on materials are suitable to apply minor shape adjustments and missing contact points. The ceramic area is blasted with the recommended aluminium oxide, cleaned, and prepared for the subsequent stain and glaze firing.



**Metal-ceramic veneer, layering technique, horizontally screwed down**

■ Metal-ceramic veneering materials are layered onto the superstructure. After two to three firing cycles, the best possible, functional and aesthetic result should have been achieved.



After the final adjustments of the anatomical shape and the texture of the ceramic surface, the stain and glaze firing is conducted.



With rigid, implant-retained superstructures, the important functional occlusion has to be precisely adjusted by grinding and thoroughly checked. No interfering contacts or disturbances of the masticatory function may occur.



Finally, the accuracy of fit, functional occlusion, shade, and hygiene capability of the metal-ceramic superstructure are thoroughly checked.





The completed, metal-ceramic superstructures on customized titanium abutments.

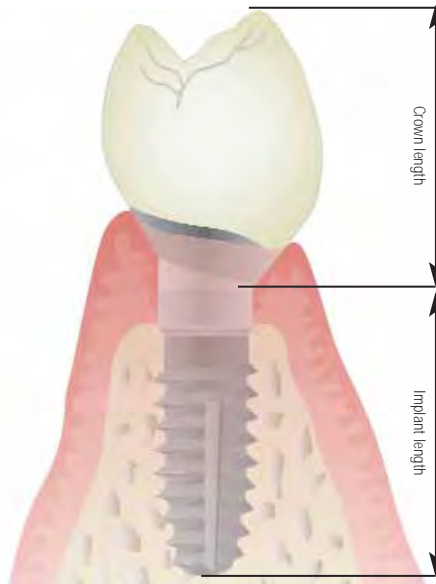


The high gold Callisto Implant 78 alloy was used for the fabrication of the superstructures, while IPS InLine and IPS InLine PoM (Press-on-Metal) ingots were used for the metal-ceramic veneers. The processing instructions of the manufacturer Ivoclar Vivadent must be carefully observed.



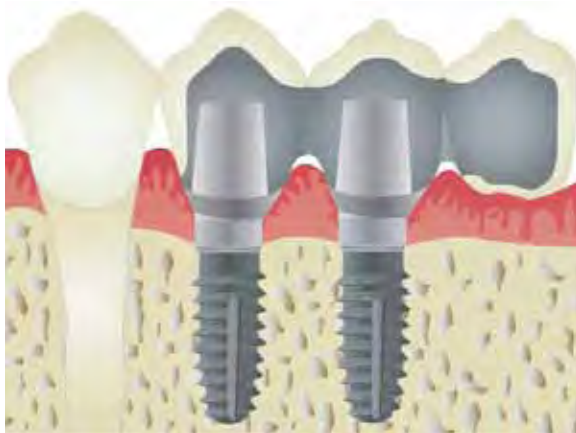
**Important:**

The implant should be longer than the superstructure. The implant type should be taken into consideration and the instructions of the implant manufacturer carefully observed.



**Important:**

Cantilever units may only be attached to at least two interconnected superstructures and must demonstrate a reduced shape (premolar width).



## Zirconium oxide framework / all-ceramic

Titanium abutments, zirconium oxide framework, press technique, conventional or adhesive cementation

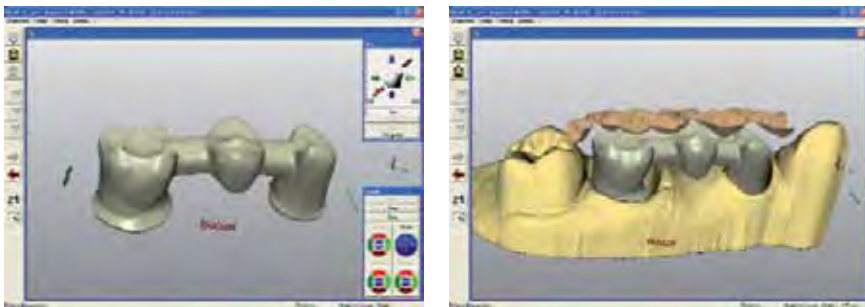
IPS e.max® ZirCAD – partially sintered zirconium oxide blocks

IPS e.max® ZirPress – fluorapatite glass-ceramic ingots

IPS e.max® Ceram – nano-fluorapatite glass-ceramic

For the fabrication of all-ceramic superstructures on titanium abutments, a zirconium oxide bridge framework is produced using CAD/CAM procedures.

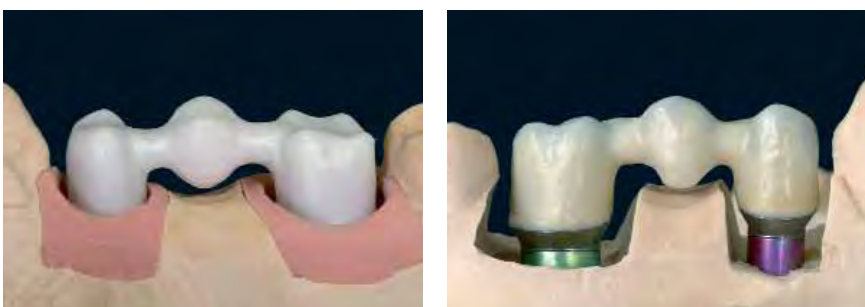
The zirconium oxide bridge framework must feature adequate strength. The framework design should support the shape and cusps and permit an even, all-ceramic veneer/pressing-over.



In a first step, the accuracy of fit of the milled and sintered zirconium oxide bridge framework is checked and adjusted, if necessary.



Before ZirLiner is applied, the framework must be free of dirt and grease. ZirLiner is applied, and, if required, the shade is modified using Shades. The subsequent ZirLiner firing results in a sound bond, as well as in a true-to-nature, in-depth shade and fluorescence effect.



The fully anatomical wax-up using wax that fires without leaving residue is fabricated on the prepared zirconium oxide framework. The entire contouring and the contact points are thoroughly checked.



Sprueing, investing, pressing-over, and divesting are carried out according to the IPS e.max ZirPress Instructions for Use. Subsequently, the reaction layer produced is removed with the Invex liquid and the restoration carefully blasted using  $\text{Al}_2\text{O}_3$  at 1–2 bar pressure.



The sprues are removed using a thin diamond wheel and the contact areas smoothed out at low speed and low pressure. Next, a lifelike shape and surface texture are created. Following this, the superstructure is fitted to the model.



**Important:**

Suitable grinding instruments are indispensable for finishing glass-ceramic materials (please observe the corresponding recommendations from Ivoclar Vivadent).

After the final adjustments of the shape and texture of the ceramic surface, the contact points are checked. Then, the stain and glaze firing is conducted.



Finally, the accuracy of fit, functional occlusion, shade, and hygiene capability of the all-ceramic superstructure are thoroughly checked.



The completed, layered all-ceramic superstructure on customized titanium abutments.



All-ceramic superstructure



The framework materials IPS e.max ZirCAD, IPS e.max Ceram ZirLiner 1, the press ceramic materials IPS e.max ZirPress, IPS e.max Press Invex Liquid and the all-ceramic veneering material IPS e.max Ceram were used for the fabrication of the superstructure. The corresponding Instructions for Use of the manufacturer Ivoclar Vivadent must be carefully observed.

# Literature

*We would like to thank Camlog Biotechnologies AG and Institut Straumann AG for the complementary illustrations.*

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# Overview of Ivoclar Vivadent alloys for implant superstructures

Already today, a large number of our alloys meet the materials science requirements for implant superstructures - even though they feature very different compositions. Furthermore, the alloys have also been tested with regard to their compatibility with veneering ceramics, such as IPS d.SIGN®, IPS InLine®, IPS InLine® PoM, and IPS Classic®, or the veneering composite SR Adoro®. These materials enable quick processing.

Crown and Bridge alloys	Au	Pt	Pd	Ag	0.2 % proof stress	E-modulus	Cast-on capability	Compatible with		
								SR Link / SR Adoro	SR Chroma Link / SR Chromasit / SR Link	SR Link / SR Ivocron
<b>High Gold content:</b>										
Harmony® KF	75.1	3.2	6.8	10.2	530	84.000	✓	-	-	-
Harmony® PF	72.0	3.6	-	13.7	525	89.000	✓	✓	✓	✓
Academy Gold™ XH	70.7	3.59	-	13.7	505	86.000	✓	✓	✓	✓
<b>Reduced Gold content:</b>										
Harmony® X-Hard	68.3	2.9	3.6	10.0	735	93.000	✓	✓	✓	✓
XL-X®	62.8	-	3.9	16.1	750	87.000	✓	✓	✓	✓
Magenta®	50.0	-	6.5	21.0	820	86.000	✓	✓	✓	✓

Universal alloys	Au	Pt	Pd	Ag	0.2 % proof stress	E-modulus	Cast-on capability	Compatible with			
BioUniversal®	59.4	2.0	9.5	25.5	480	103.000	✓				

Implant alloys	Au	Pt	Pd	Ag	0.2 % proof stress	E-modulus	Cast-on capability	Compatible with			
								IPS d.SIGN	IPS InLine	IPS InLine PoM	IPS Classic
Callisto® Implant 78	78.6	9.7	7.9	-	600	110.000	✓	✓	✓	✓	✓
IS® 64	2.8	1.0	59.9	26.0	560	124.000	✓	✓	✓	-	✓
Callisto® Implant 60	2.0	<1.0	60.0	25.2	610	130.000	✓	✓	✓	-	✓

Ceramic alloys	Au	Pt	Pd	Ag	0.2 % proof stress	E-modulus	Cast-on capability	Compatible with			
								IPS d.SIGN	IPS InLine	IPS InLine PoM	IPS Classic
<b>High Gold content:</b>											
IPS d.SIGN® 98	85.9	12.1	-	-	510	80.000	✓	✓	✓	✓	✓
Aquarius XH	82.8	9.0	5.0	-	510	83.000	✓	✓	✓	✓	✓
Y-Lite	75.0	-	18.8	2.0	500	88.000	✓	✓	✓	✓	✓
Sagittarius	75.0	2.0	16.8	2.0	580	94.000	✓	✓	✓	✓	✓
<b>Reduced Gold content:</b>											
IPS d.SIGN® 91	60.0	-	30.55	-	500	108.000	✓	✓	✓	✓	✓
W-5	52.2	<1.0	26.0	17.1	505	118.000	✓	✓	✓	-	✓
Lodestar®	51.5	-	38.5	-	495	98.000	✓	✓	✓	✓	✓
W-3	48.7	-	39.6	-	495	128.000	✓	✓	✓	✓	✓
<b>Palladium based:</b>											
Capricorn 15	15.0	-	51.9	23.0	490	101.000	✓	✓	✓	-	✓
IPS d.SIGN® 84	9.0	-	75.2	3.0	495	117.000	✓	✓	✓	✓	✓
IPS d.SIGN® 67	4.0	-	62.7	20.0	545	104.000	✓	✓	✓	-	✓
Spartan Plus	2.0	-	78.8	-	795	97.000	✓	✓	✓	✓	✓
IPS d.SIGN® 59	-	<1.0	59.2	27.9	490	139.000	✓	✓	✓	-	✓
IPS d.SIGN® 53	-	<1.0	53.8	34.9	545	132.000	✓	✓	✓	-	✓
W-1	-	-	53.3	37.7	485	114.000	✓	✓	-	-	-

Predominantly base alloys	Co	Cr	Ga	Nb	0.2 % proof stress	E-modulus	Cast-on capability	Compatible with			
								IPS d.SIGN SR Link / SR Adoro	IPS InLine SR Chroma Link / SR Chromasit / SR Link	IPS InLine PoM SR Chroma Link / SR Chromasit / SR Link	IPS Classic SR Link / SR Ivocron
IPS d.SIGN® 30	60.2	30.1	3.9	3.2	520	234.000	-	✓✓	✓✓	✓	✓✓

The range of alloys may vary from country to country

# Overview of Ivoclar Vivadent products

Overview of the Ivoclar Vivadent products for implant superstructures mentioned in this Manual:

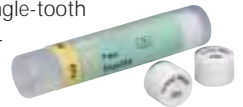
## SR VivoTAC / SR Ortho TAC

Prefabricated, radiopaque teeth / radiopaque powder/monomer system.



## IPS e.max® Press

High-strength, aesthetic lithium disilicate glass-ceramic ingots for the pressing of single-tooth restorations and up to three-unit implant superstructures.



## Light Tray

Light-curing single-component composite in preformed trays (maxilla and mandible).



## IPS e.max® ZirPress

Fluorapatite glass-ceramic ingots made of IPS e.max ZirCAD or sintered/hipped zirconium oxide to be pressed onto single-tooth copings and bridge frameworks.



## SR Ivocron®

Two-component PMMA C&B veneering material for the fabrication of veneers and long-term temporaries.



## IPS e.max® ZirCAD

Partially sintered zirconium oxide blocks in four different sizes for the fabrication of frameworks for single tooth restorations and bridges.



## IPS d.SIGN® 98

High gold ceramic alloy for the fabrication of implant superstructures.



## IPS e.max® Ceram

Nanofluorapatite glass-ceramic for the veneering of pressed ceramic, as well as the CAD/CAM-milled framework materials of the IPS e.max System.



## Callisto® Implant 78

High gold implant alloy for the fabrication of implant superstructures.



## Stratos® 300

Individually adjustable bio-functional articulator.



## IPS InLine®

Easy, efficient-to-process leucite metal-ceramic in Chromascope, A-D and Bleach BL shades for a wide variety of alloys.



## UTS 3D Universal Transferbow System

Universal transferbow for patient-specific, skull/joint related orientation of the models in the Stratos articulators.



## IPS InLine® PoM

Leucite glass-ceramic ingot to be pressed onto metal frameworks (fully anatomical pressing).



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Printed in Germany  
604502/0108/e/W



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