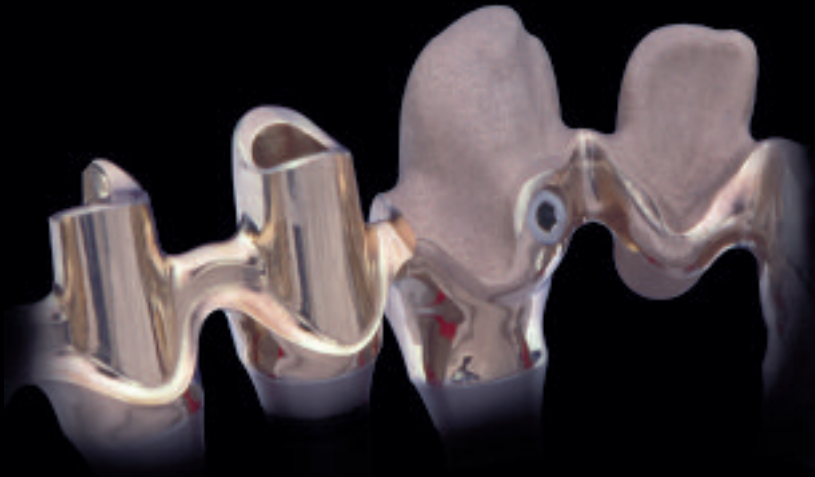


Gold-Standard for Implant Superstructures

Special Edition



A stylized white signature of Udo Buhr on a black background.

Udo Buhr





Comparisons, like allegories, result in different things being compared to each other leading to new approaches.

Even the "micro-cosmos dental technology" does not remain untouched. The signs of the time point towards metal-free restorations. Does dental technology lose its old operating system, i.e. the precious metal technique?

In dentistry, gold in many variations is a material that has been used for more than a hundred years. Gold alloys have been clinically investigated again and again since that time and always scored outstanding results with regard to compatibility and durability. That is why gold alloys and thus the precious metal technique will stay around for the future.

It will be decisive, however, how this mixed material is processed. Not least because precious metal alloys are medical products, their processing must be mastered. After all, the well-being of the patient and the corresponding comfort of wear exhibited by our anatomical reconstructions are in the foreground.

Discourse on techniques



The processing of mixed materials known as "precious metal alloys" is very complex and directly depends on the technical indication. Well-founded knowledge of all the disciplines of material processing is further promoted by a pronounced willingness and enthusiasm to learn new things and implement them accordingly.

The complex processing steps have to be supported by a high performance level as far as the casting technique is concerned. The precision is confirmed by the excellent accuracy of fit of all framework indications without having to sacrifice the creative design of the framework. This results in a set of important parameters required to ensure the permanent reproducibility of precise casting results.

Model situation

Model fabrication

The basis of each working procedure in the dental laboratory is an outstanding and reliable base or master model. For the fabrication of this implant-retained restoration, the model analogs (RN synOcta Gold coping) are used in conjunction with plastic modelling aids. The situation on the stone model exactly represents the implant position in the oral cavity. The transfer of the model analogs is achieved with the help of what is known as passive splinting. This is already a significant aspect in the examination and discussion of the dimensional stability of impressions.



The representation of the soft tissue structure indicates the course of the gingiva in the oral cavity. The model analogs, on which the 1.5 mm RN synOcta secondary parts are mounted, represent the starting situation. The screwed down gold copings capable of being cast on indicate the available modelling space in the sulcus. The completeness, i.e. the high level of the papilla and the excellently conserved anatomical gingiva profile, requires utmost homogeneity of the casting structure. After all, achieving an attachment gingiva that is entirely free of inflammation is an important focal point in precious metal processing. The promised wear comfort must be confirmed by outstanding hygiene capability in these critical areas.



The vertical space conditions between the maxilla and the mandible become visible in articulation. For further clarification, the situation is shown with and without gingival mask. The implant inclination towards the vestibular and the considerable inclination angle are easily noticeable.



Primary structure

Contouring

Adjustments are added on the implants using a wax-up. The oral situation can be transferred to resin that fires without leaving residue by means of a silicone key. What is known as the rough body is finished and repositioned on the model. It is fundamental that the planning also takes the natural tooth extension into consideration. Interferences to phonetics due to severe over-contouring possibly caused by unfavourable implant positions also have to be taken into account. Optimum hygiene capability is also related to this aspect. Sound working procedures considerably support the subsequent design of the framework.



Exact silicone keys are now used to check the functional milling of the resin framework.

In a first step, the vertical screw openings are exposed, so that the prosthetic screws can be loosened and removed without any problems.



In the wax-up without model, the exposed transition areas to the gold copings are visible. In order to prevent damage to the gold copings, the wax is removed from the cervical areas, which are thus kept clean of resin. In this way, adjustments by grinding and finishing have become superfluous.



The framework is designed by controlled reduction of the wax-up. The clean silicone matrix permits quick and reliable orientation. Each surface requires two silicone keys. While the first matrix reproduces the entire surface from cervical to incisal, the second matrix is bisected horizontally. In this way, the labial-palatal surfaces can be checked from the occlusal. The mesostructure must provide sufficient space for the secondary framework and also pre-determine the statically relevant separation spaces, as well as the cervical parts of the tooth shapes.



The final step in designing the mesostructure is to adjust the transition areas from the margin of the gold coping to the milling surfaces using a modelling resin that fires without leaving residue (Pattern Resin). Only a homogeneous transition in the wax-up ensures a gap-free transition to the gold coping. A bubble-free resin framework is the prerequisite for a sound and smooth cast. Without the isolation of the cervical areas, such a gentle and quick finishing of the structure is impossible.



The occlusal-incisal space conditions are checked in the articulator at regular intervals.

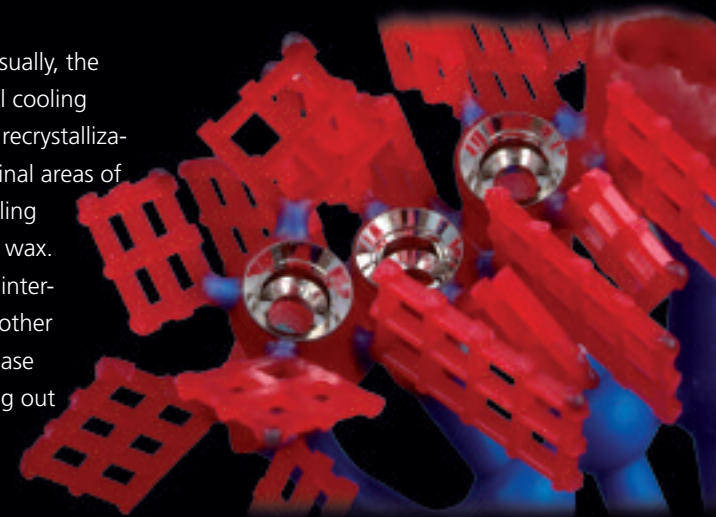


Sprueing / Investing

Tension-free accuracy of fit of the wax-up can only be achieved if the sprues are waxed-up independently of the framework. When attaching the sprues to the framework, the free access to the prosthetic screw must be checked and ensured. The framework remains secured by means of the prosthetic screws until it has been completed and the sprues have been attached.



The wax-up is completed with an even and clean coat of wax. Usually, the highest tensile stress occurs in the area of the interlocks. Bilateral cooling grids attached as symmetrical as possible ensure quick and even recrystallization of the alloy both in voluminous areas and the delicate marginal areas of the framework structure. The close spacing of the individual cooling grid elements is facilitated by symmetrically attaching them with wax. Since the cervical framework areas line the gingival contour, the inter-crystalline lattice structure must be absolutely homogeneous. In other words, the mixed material "alloy" must demonstrate a single-phase atomic lattice structure after recrystallization. In this way, washing out of the alloy components can be prevented.

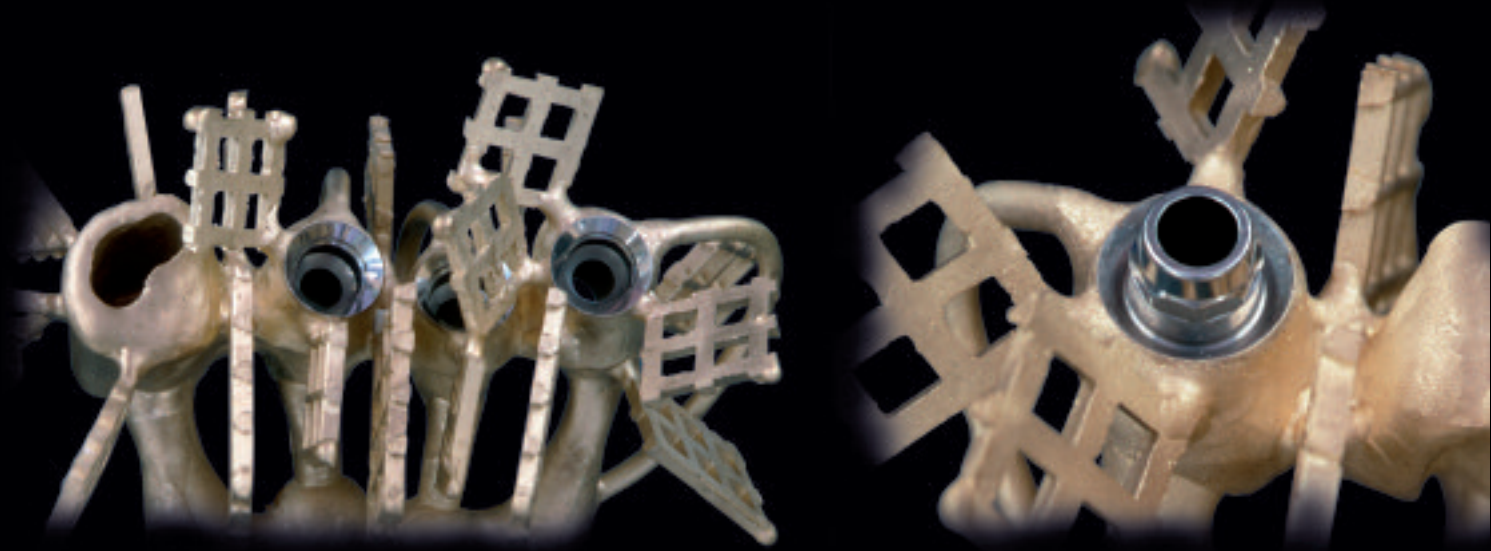


The correct position of the object in the casting ring significantly contributes to the accuracy of fit. The ring wall should always be adjusted to the framework shape. This means that the framework structure should be positioned parallel to the ring wall for optimum results. Furthermore, the crown margins or abutment cylinders should always be vertically aligned towards the top. The objects are then invested using a phosphate-bonded investment material. Stability and wide-range expansion control is a big advantage, particularly for multi-unit frameworks.



Casting / Finishing

The use of resin that fires without leaving residue additionally requires that holding times are observed during the heating of the casting object.



The Academy Gold XH alloy is cast in the vacuum-pressure technique observing the casting parameters to obtain a homogeneous cast. In order to achieve optimum accuracy of fit, the investment material in the area of the gold coping capable of being cast on must not be removed by means of blasting media (Al_2O_3). Investment material residue must be removed by means of acid treatment.



The targeted placement of the cooling grids enables homogeneous casting results (Academy Gold XH), particularly in the transition areas to the inner aspects of the copings. Upon injection of the alloy, a desired loss of energy occurs, which results in quick solidification of the alloy, also known as germination. The cooling grids ensure that no impact pressure occurs in the shoulder area during the casting procedure. It is very likely that this also prevents frequent overshooting of the HSL copings by the melt.



With precise planning and execution, the desired framework structure is created in the milling device.



The detailed images show accurately cast HSL copings. Milling the cervical areas of the structure is extremely difficult. The shoulders of the implant platform are convex-conical and thus do not allow deep lowering of the shoulder milling. The profile of the milling range is exhausted with the perforation of the gold structure.



The primary framework is regularly checked in the articulator. The available space for the secondary structure and the veneer are checked with the help of the silicone matrix. At the same time, the palatal and labial milling surfaces are checked.



Secondary structure

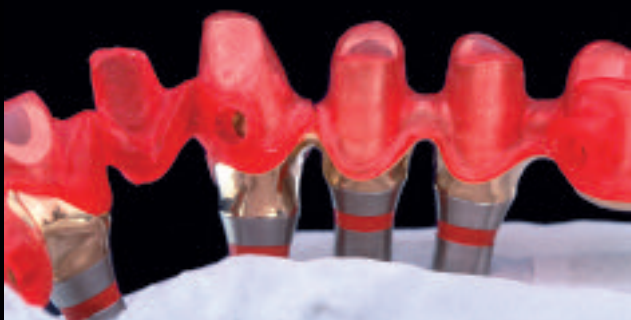
Contouring



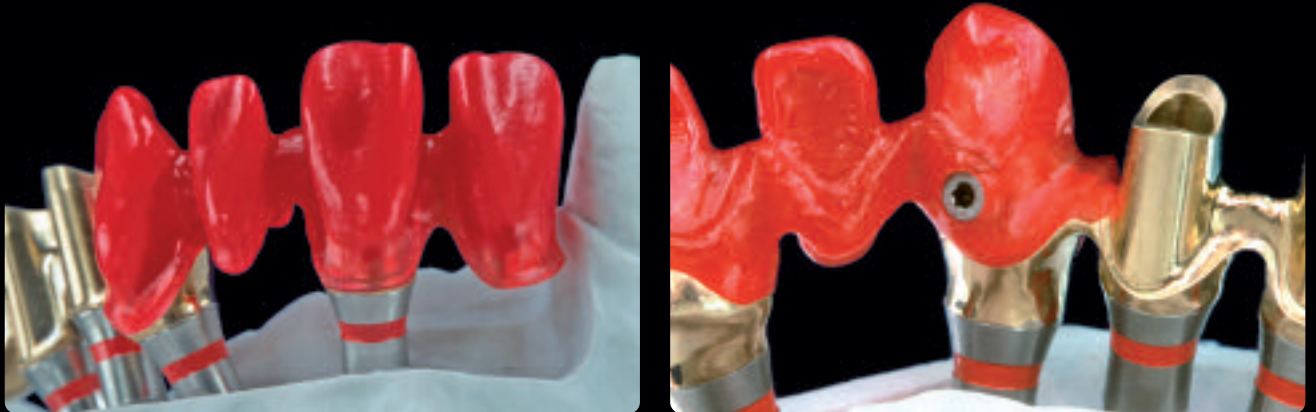
The mesostructure is the primary interlock between the individual implants. An exactly designed primary structure results in an even secondary framework. This also significantly supports the joining of the two framework structures.



A high-quality restoration is characterized by its details. Before contouring, the transverse screw is entirely screwed in and carefully sheathed with modelling resin. Drilling a screw connecting through the primary and secondary framework does not result in the desired cold welding and thus the required strength.



A stable framework made of modelling resin that fires without leaving residue is applied on the milling surfaces. After one hour, the framework can be removed and evenly finished. The grinding instruments must demonstrate ample sharpness, since no high grinding resistance should occur. Thermoplastic deformation during finishing often prevents sound accuracy of fit. However, the nevertheless intensive mechanical stress during finishing of the new structure requires targeted adjustment of the entire marginal area.

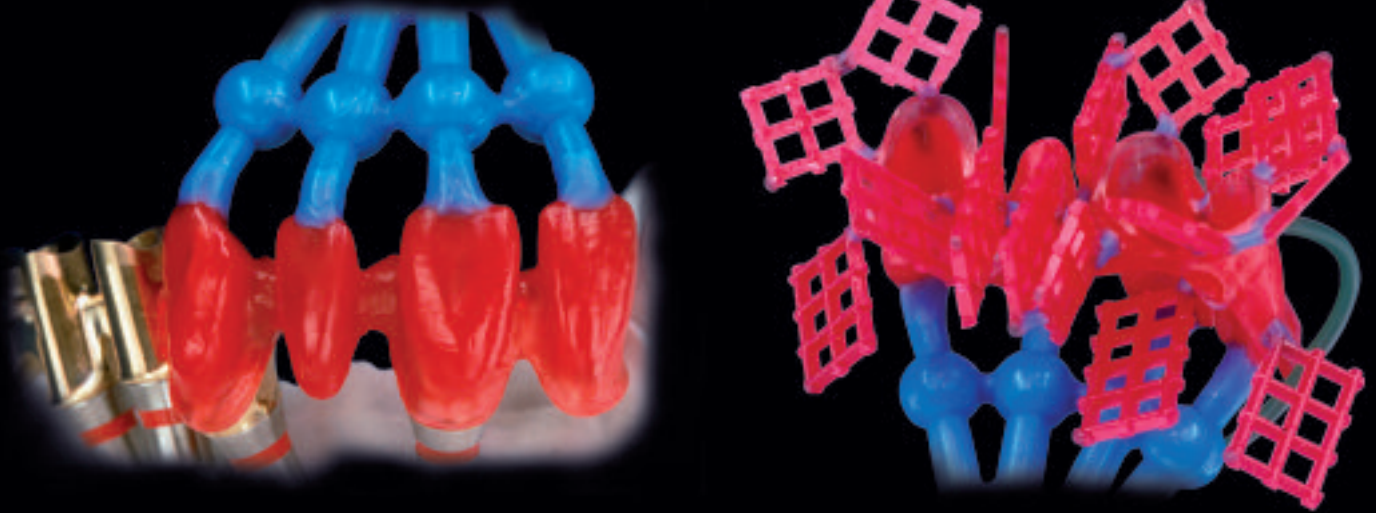


The completed resin framework is anatomically supplemented with wax. In order to work as fatigue-free as possible, wax of the same colour should be used. Different wax colours quickly lead to tiredness of the technician and thus impede the examination of the contouring. For exact accuracy of fit after casting, particularly in the separation area between teeth 23 and 24, the anterior region of the secondary framework is cast first.

The silicone matrix is again used to check the necessary space conditions. It must be ensured that the framework is not over-contoured in accordance with the original planning.

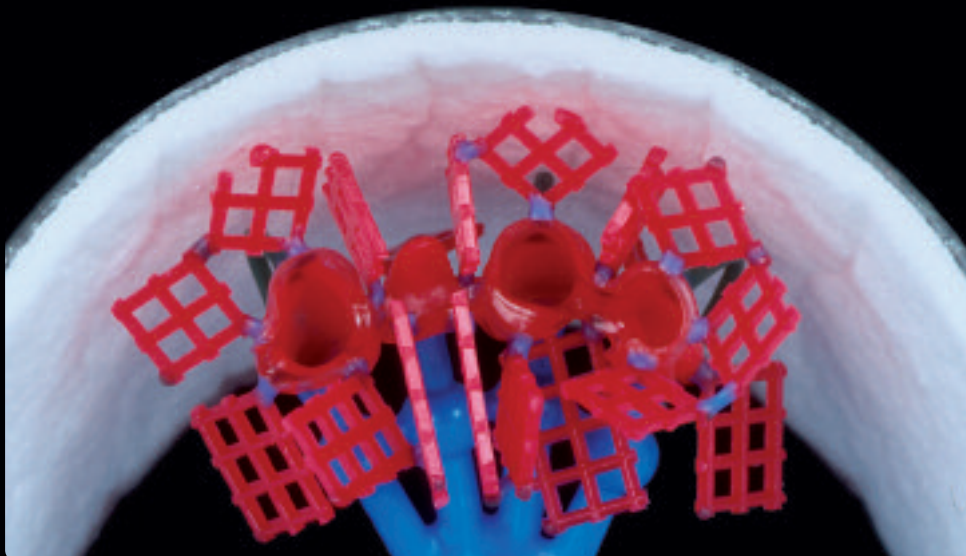


Sprueing / investing

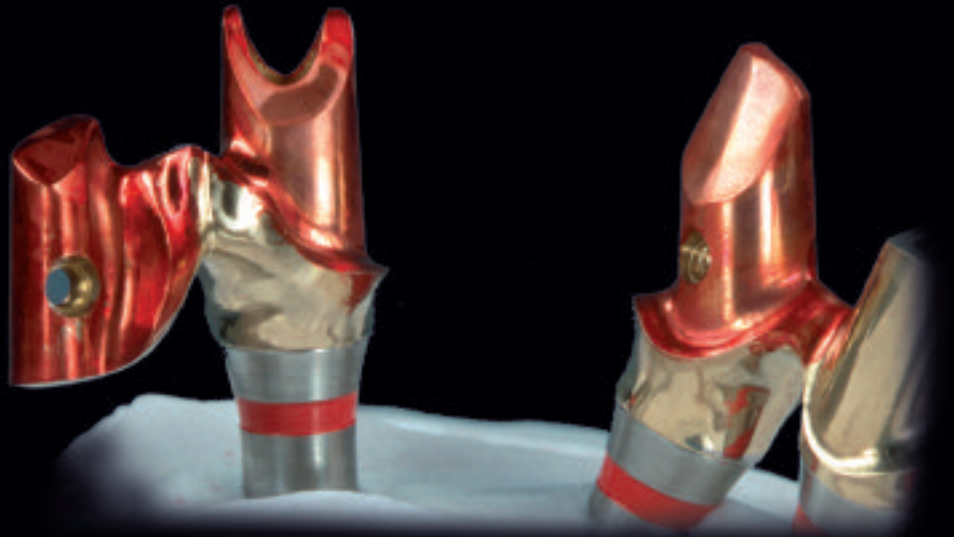


Sprueing the veneering framework, also known as the secondary structure, requires the same technical prerequisites as the sprueing of the primary structure. The complex marginal contour and the presence of a transverse screw represent a high degree of difficulty in joining the two structures.

As was the case for the positioning of the primary structure, the delicate secondary structure requires a particularly good eye. Trying to adjust a cast secondary framework is technically not feasible and will thus lead to renewed fabrication of the structure. The selection of the alloy is equally important as the preparatory steps for the casting procedure. The alloy used, i.e. Brite Gold XH, is characterized by its easy processing properties, particularly when cast.



Sprueing / Investing



The fitting of the secondary framework with absolutely no distortion of the primary structure requires concentrated joining navigation.

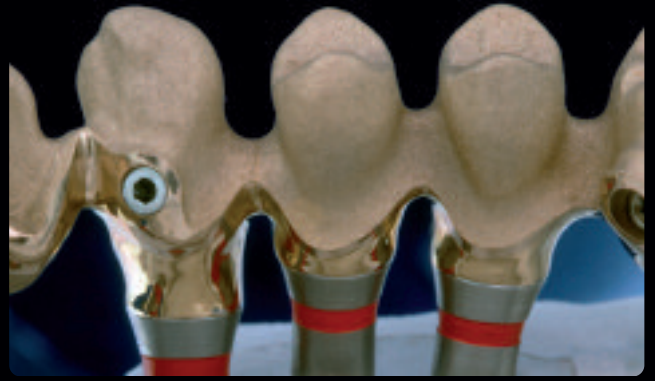
Joining navigation equals the least possible efforts to join the two framework structures. The image shows how the primary structure is wetted with a waterproof ink. This allows the careful and precise detection of any interfering contacts in the copings, as well as their subsequent removal.



Secondary structures cannot be fabricated with an arbitrarily wide radius. Therefore, the planning of the primary structure must also determine the areas where the secondary structure can be separated. In this case, the framework is separated between teeth 23 and 24. The joining of the seams is successful if the anterior framework is placed flush on the primary framework demonstrating sound marginal seal. Only then may the second part be joined without any dimensional deviation.



The clean resin sheath covering the primary structure forms the necessary base for the subsequent anatomic contouring. Finally, the posterior framework part must also be carefully checked in the articulator by means of the silicone matrix.



The casting procedure for the secondary structures using Brite Gold HX is the same as described above. In this context, however, the shape-supporting design for the IPS d.SIGN veneering ceramic, as well as the considerations regarding the periodontal hygiene capability, are important aspects. The accuracy of fit of the framework structures can be checked on the model without a gingiva mask.



The detailed images reveal that the knowledge of the correct processing of the various materials results in outstanding accuracy of fit. The transition areas of the marginal contours, particularly in the inner aspects, underline the successful joining of the structures and the high level of craftsmanship. With the targeted and limited material reduction during fitting, the crown walls rest flush on the primary framework in an optimum manner. A continuous and even joint has been achieved. The modelling space in the sulcus described in the beginning has to be given special attention, as well as the resulting multi-wall framework profile proportionate to it. The profile finish enables unrestricted hygiene capability. The design of the palatal / basal surfaces represents a virtual exhaustion of the technical possibilities of craftsmanship in the conventional precious metal casting technique.

By veneering one side of the Brite Gold XH framework with IPS d.SIGN, it becomes clear that the framework support to absorb the masticatory forces exerted on the veneering material has been ideally achieved. Hence, a functional framework does not need to be contradictory to its aesthetic appearance.



List of materials

Implant	RN synOcta	Institut Straumann AG
Gingiva mask	GI-MASK	Coltène Whaledent
Resin that fires without leaving residue	Pattern Resin	GC
Alloy for the primary framework	Academy Gold XH	Ivoclar Vivadent AG
Alloy for the secondary framework	Brite Gold XH	Ivoclar Vivadent AG
Veneering ceramics	IPS d.SIGN	Ivoclar Vivadent AG
Stone	Implantat-rock	picodent

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