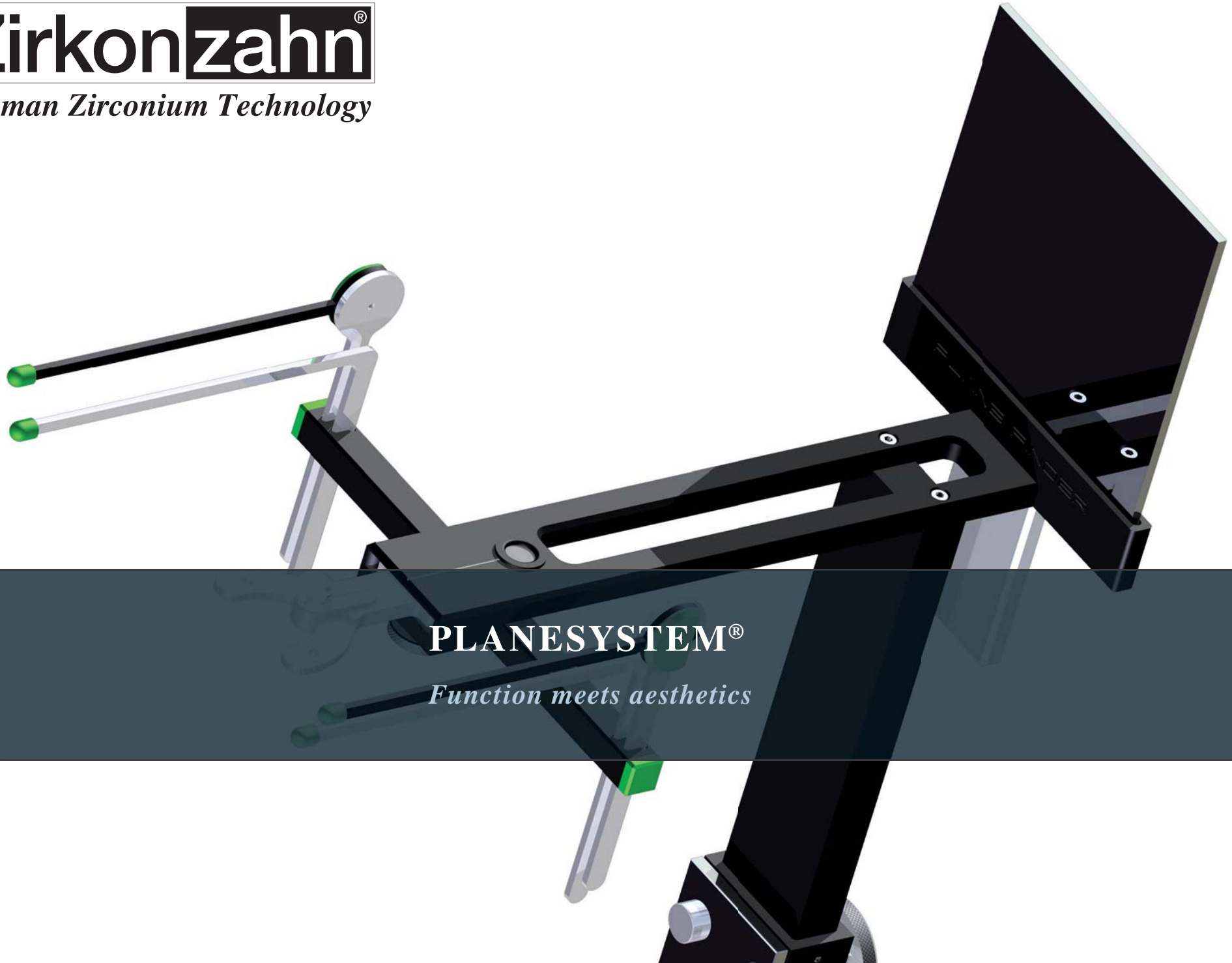
Zirkonzahn®

Human Zirconium Technology



PLANESYSTEM®

Function meets aesthetics

ENGLISH

WHEN IT COMES TO HEALING …

... only the best is good enough. For this reason, we decided to work with my long-time colleague, Udo Plaster, in the realm of patient and model analysis.

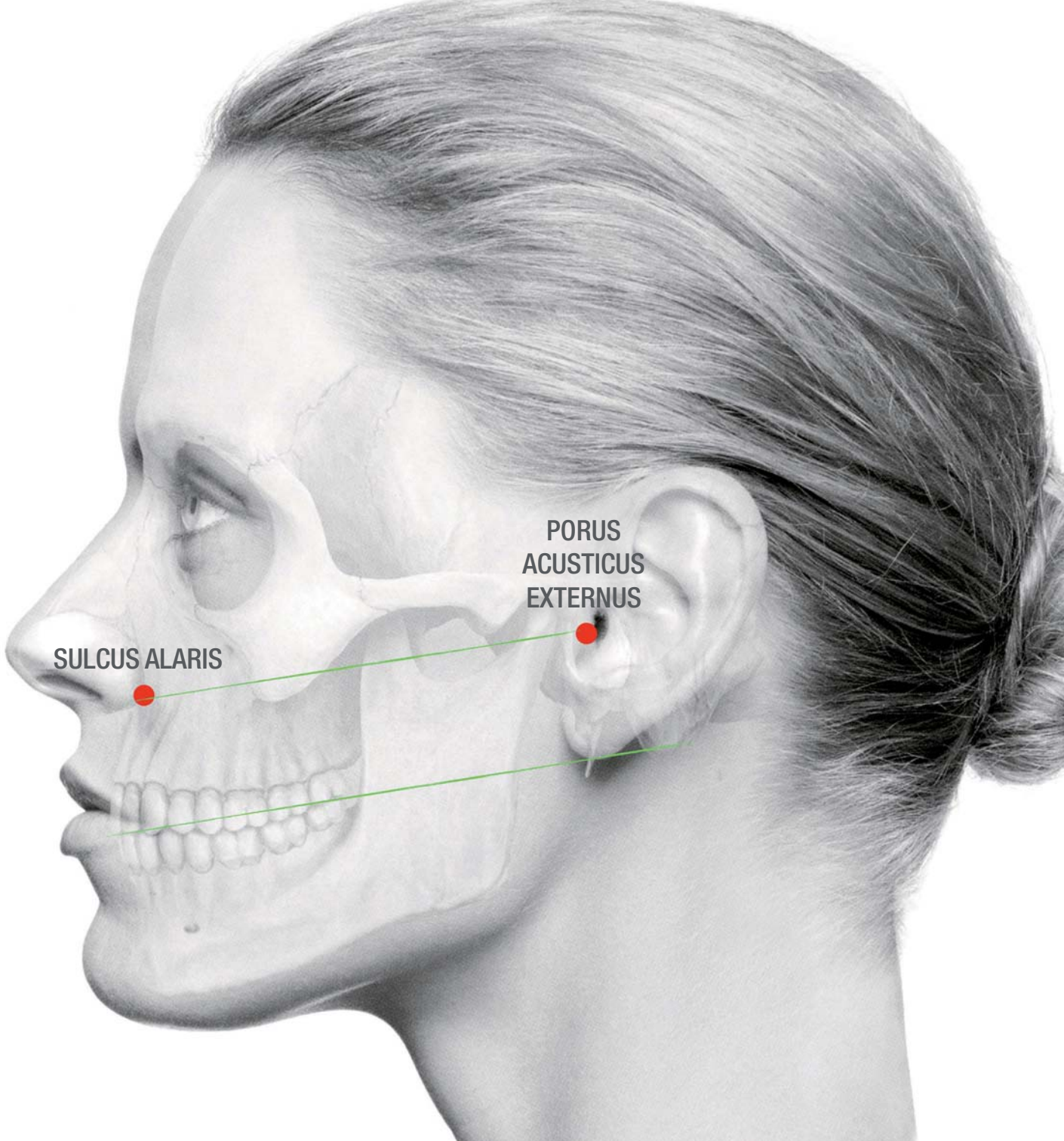
His PlaneSystem® is a transfer method that respects and recognizes the patient as a person. Whether we choose the digital or the traditional route in the preparation of dental restorations – the accurate recording of patient data by the PlaneSystem® will pave the way for the pursuit of complete health. Our company's software developers have integrated the PlaneSystem® into the Zirkonzahn CAD/CAM workflow. We have pledged our knowledge and our competence, as well as our organizational structures and international presence, in support of the PlaneSystem®.

So on the path towards a digital facebow, Zirkonzahn, with its Face Hunter 3D facial scanner, developed in-house, and the PlaneSystem®, has taken two major hurdles and enjoys the infinite benefits that hard work and human effort can produce.

We encourage you to join us in aspiring to more, in being open to new developments and curious for new in-depth knowledge!

PlaneSystem® – developed by Udo Plaster MDT in cooperation with Zirkonzahn

ALA TRAGUS



FUNCTION MEETS AESTHETICS IN A DIGITAL WORKFLOW

Dental technicians need optimally precise data about each patient's individual situation to develop restorations in a virtual environment. The more precise the data, the better the achievable function and aesthetics of design (Fig. 1). In some situations, however, the technician will be unable to exploit the full potential of CAD planning software. This case may arise in the absence of information on how an available pair of casts relates to the rest of the body.

Fig. 1: Ideal situation characterized by completely precise transfer of the natural maxillary and mandibular positions to the articulator and into the CAD software

OCCLUSAL PLANE AND MIDLINE

The precise position of the human maxilla, which forms an integral part of the skull, varies from individual to individual depending on skeletal growth types, and the orientation of the occlusal plane is dictated by the growth pattern of the maxilla and mandible. For example, less growth of the mandible relative to the maxilla will normally involve an increasingly steeper orientation of the natural occlusal plane (Fig. 2). Differences in occlusal plane inclination may even be present within individuals (due to natural bone volume asymmetries on both sides of the face) and can be verified based on the ala tragus line (Fig. 3). The absolute midline of the face is another suitable reference to identify natural asymmetries of the dental arch. This vertical line passes through the nasion (point between the eyebrows) and the subnasal point (point below the nasal tip). Normally, it will coincide with the skeletal midline that runs along the palatal suture. The dental midline, by contrast, will normally depart from the absolute midline by varying degrees to the left or right (Fig. 4). It is generally assumed that no human skull ever grows to ideal symmetry. The fact that the stomatognathic system is nevertheless capable of accomplishing its function results from the body's ability to offer some compensation for asymmetries through its muscles. Over time, this fundamental asymmetry can be compounded by additional asymmetries developing in the jaws because of tooth loss, reduced vertical

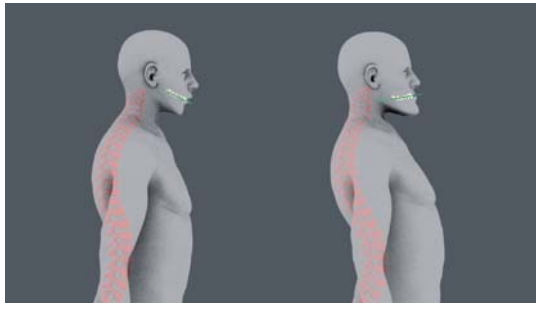


Fig. 2: Skeletal growth types with different orientations of the occlusal plane

dimension, changes in bite position, or orthodontic interventions. Any of these natural or induced asymmetries cause the organism to compensate, giving rise to asymmetric loads that may affect the whole body. Excessive loading may result in pain or damage to the body parts affected.

Dental restorations may also be a cause of asymmetric loads inside the body. These may be avoided, however, if the clinician succeeds in determining the natural position of the maxilla within the body and to determine how any asymmetries that may be present relate to this position. But what options are there available for the clinician to achieve this goal?

FACEBOWS AND TRANSFER BOWS

Conventional facebows and transfer bows have traditionally yielded good results in fabricating dental restorations. Experience tells us, however, that numerous try-ins and adjustments are normally required before a patient will be satisfied with the functional design of his or her dental restoration. This need arises from incomplete information about the maxilla, as familiar measuring techniques do not use reference

Fig. 3: The occlusal plane of this individual is differently inclined on both sides of the maxillary dental arch. The inclination of the occlusal plane coincides with the inclination of the ala tragus lines.

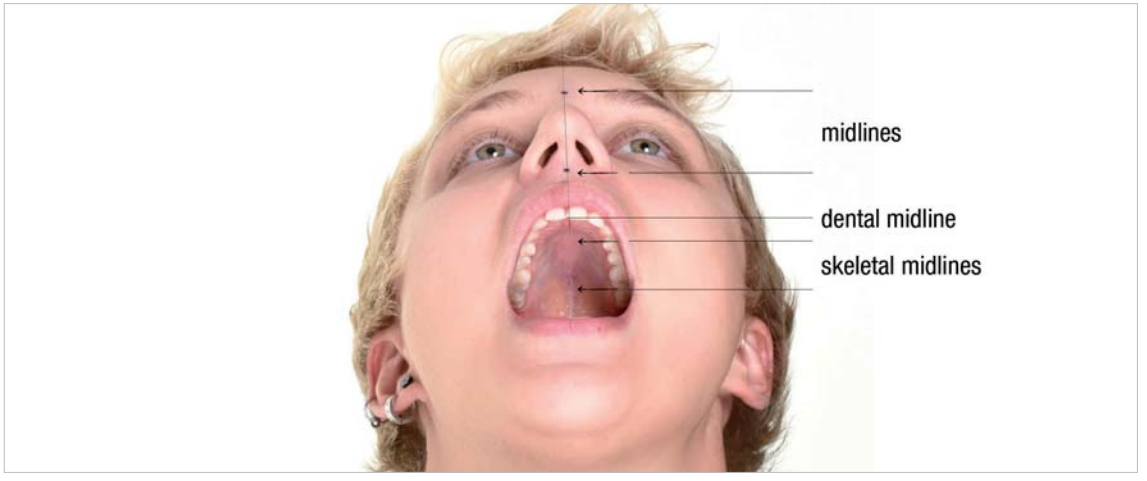


Fig. 4: The absolute and skeletal midlines usually coincide, while the dental midline is not normally located along this line.

points and reference planes suitable to record the natural position of the maxilla directly from the patient for subsequent transfer to the articulator. Yet data about the position of the maxilla are essential to identifying the patient's midline and occlusal plane for consideration in fabricating the dental restoration. The technician needs both of these parameters to appropriately position the dental reconstruction inside the jawbone, thus closely imitating the natural ideal and avoiding the development of asymmetric loads inside the body.

THE PLANESYSTEM®

This system offers an alternative to conventional facebows in this regard. The name PlaneSystem® was selected to reflect the crucial role of the planes that the system identifies in the patient's face, including the absolute midline, the zero-degree reference plane, and the individual occlusal plane (captured via the zero-degree reference plane). Also, the name refers not only to the measuring and transfer method per se, but also to the specifically developed equipment and the associated software by Zirkonzahn. The system comprises four elements: PlaneFinder® (Fig. 5),

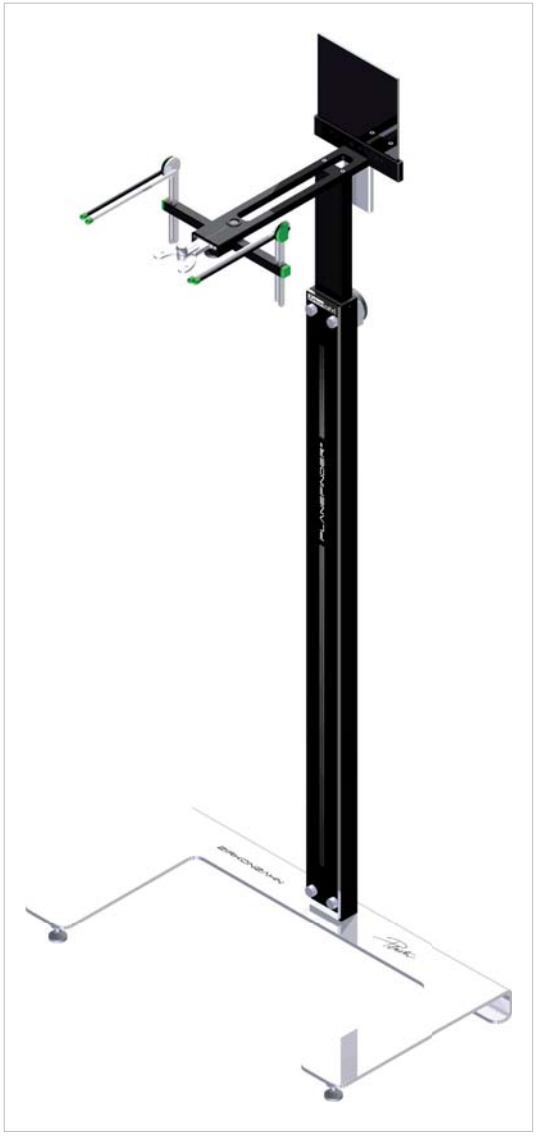


Fig. 5: PlaneFinder®

Fig. 6: The PlanePositioner® features a transparent plate used to position the maxillary cast inside the articulator and to individually reflect the natural occlusal plane

Fig. 7: PS1 articulator

Fig. 8: CAD PlaneTool PS1-3D

PlanePositioner® (Fig. 6), the PS1 mechanical articulator (Fig. 7), and the PS1-3D virtual articulator (Fig. 8).

Using the PlaneSystem®, it becomes possible to capture the natural position of the maxilla and the occlusal plane in virtually any patient conceivable. This may include cases of dentate, edentulous or prosthetically restored maxillae, as well as situations characterized by loss of dental hard tissue, bite position, or single or multiple teeth. At the source of this process is one of the numerous amazing properties of the human body. All humans, when looking into a mirror, whether sitting down or standing on both legs in a stable position, will invariably, by engaging all natural aids (eyes, neck muscles, equilibrium organ), adjust their orientation such that the head posture will intuitively be in balance with the body position and the sight axis parallel to the horizon.

This position is almost identically repeatable and reproducible at all times, offering a stable frame of reference for the PlaneSystem® to record the position of each patient's maxilla and to measure his or her occlusal plane and related facial asymmetries. The same position is also known as "natural head position" (NHP).

MEASURING AND RECORDING

Recording the natural position of the maxilla and measuring the occlusal plane starts out by placing the PlaneFinder® on a level surface and aligning its upper arm horizontally. The extension of the arm thus provides a zero-degree reference plane, horizontally hemisecting the face at a zero-degree angle relative to the floor or base surface once the patient has placed his or her head in NHP (Fig. 9). That this zero-degree angle can be revisited any time – because the NHP is reproducible – renders the reference plane independent

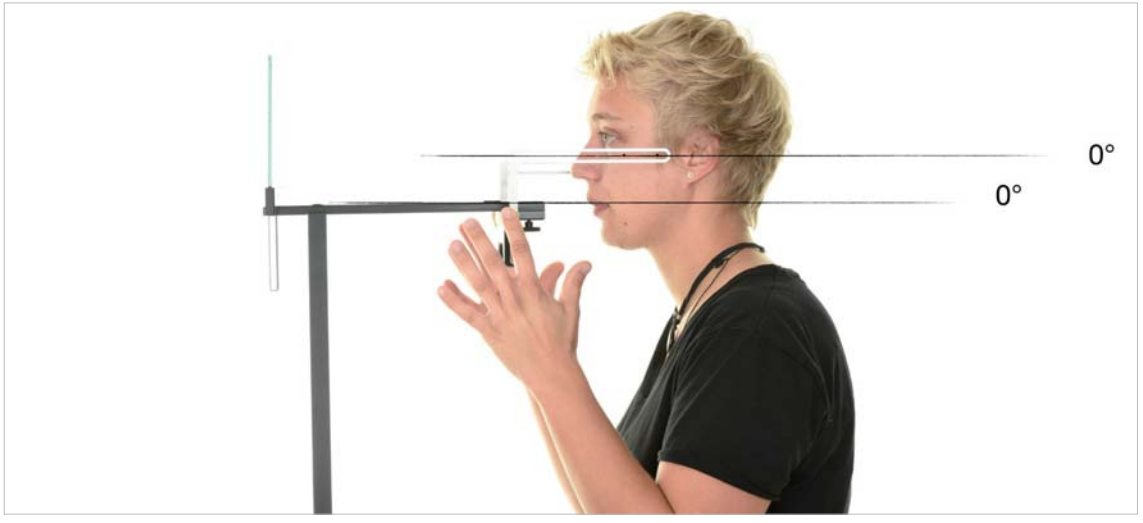


Fig. 9: Patient adopting her natural head position on the PlaneFinder®

Fig. 10: Recording of the natural position of the maxilla

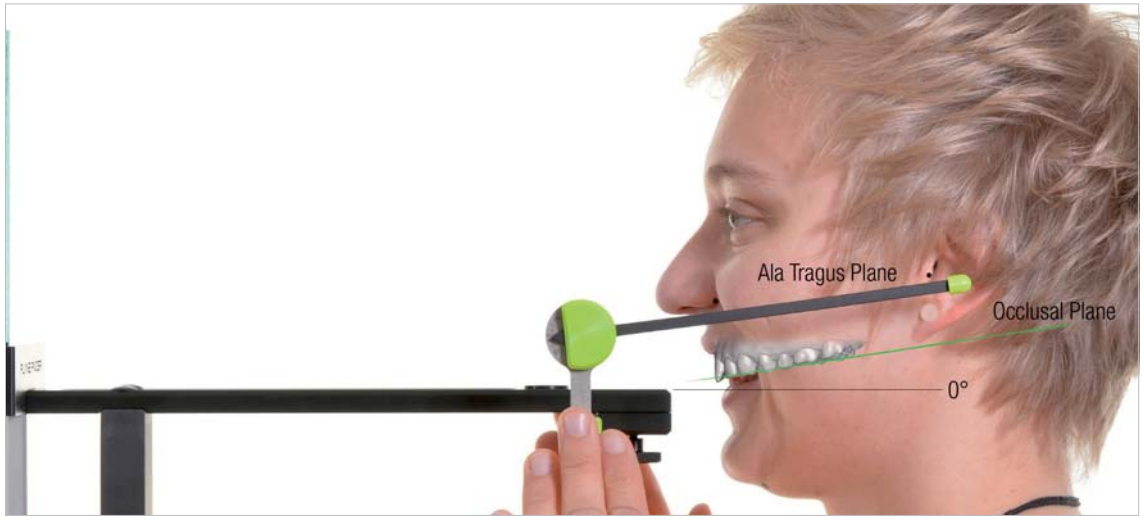


Fig. 11: The occlusal plane ...

of any physical asymmetries. An independent reference value of this type could not be ensured by using a conventional facebow, which would involve application of a symmetrical measuring instrument to the asymmetric skull while there is no way for the articulator to reflect these asymmetries.

To prepare for recording its natural position, the maxilla is placed by the patient upon a bite tray connected to the PlaneFinder®, followed by indexing of this position with bite registration material (Fig. 10). The fact that the patient will always be able to return to this position in which the reference plane has been measured guarantees the independent nature of this plane now recorded in a silicone index. The same applies to the inclination of the occlusal plane. Again, the zero-degree reference plane identified by the PlaneFinder® serves as an independent reference plane, which can be reproduced based on the patient's natural head position at any time. The inclination angle is determined based on the ala tragus line, whose orientation may be assumed to be parallel to the natural occlusal plane (Figs. 11 und 12). This line extends from the lower border of the nasal wing (ala nasi) to the cartilage before the opening of the ear (tragus). As the bilateral values for this

Fig. 12: ... may have an ascending, horizontal or descending inclination

Fig. 13: Adjusting the maxillary cast orientation based on the silicone index

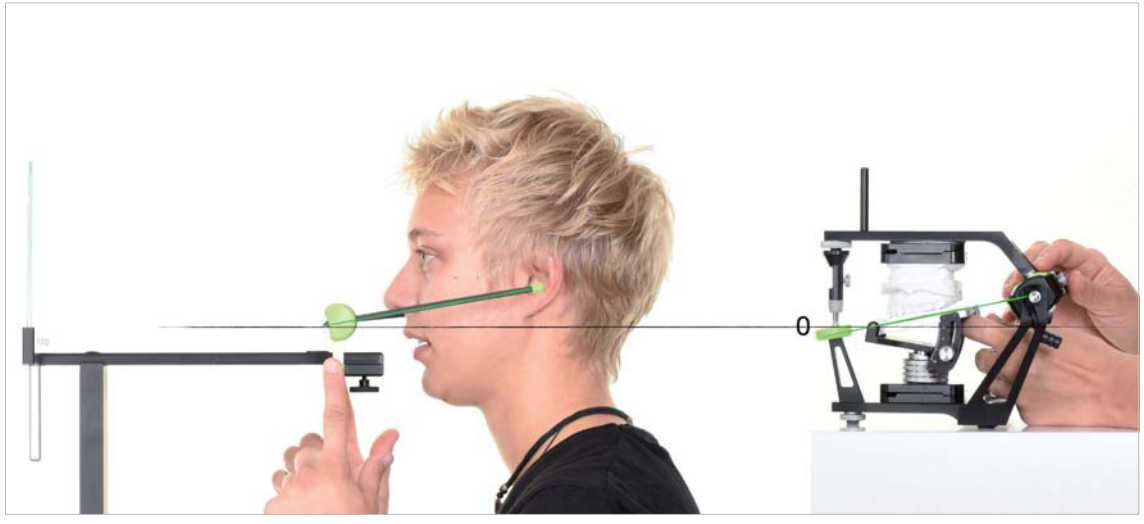


Fig. 14: Transferring the occlusal plane

inclination may vary due to natural asymmetries, its angle is measured on both sides of the face.

TRANSFER TO THE ARTICULATOR

The next step is to insert the maxillary cast into the silicone index, followed by placing the index onto the (horizontally oriented) PlanePositioner® and positioning inside the PS1 articulator, effectively "copying" the situation recorded directly from the patient to the articulator (Fig. 13). After removing the silicone index and the transparent plate, the inclination of the occlusal plane can be replicated by adjusting the PlanePositioner® inside the articulator to the angle values previously identified via the PlaneFinder® (Fig. 14).

From this point in developing the patient case, it will be possible to recheck the occlusal plane whenever the need arises on the mechanical PS1 articulator. For example, Fig. 15 shows a mounted edentulous maxilla with a temporary restoration, which was repeatedly checked for whether the occlusal plane designed at different points of developing the case coincided with the natural occlusal plane that had been recorded directly from the patient.

Fig. 15: Ideal setup for repeatedly checking the occlusal plane through different stages of developing the case

Fig. 16: Scan of the mounted cast

Fig. 17: Virtual presentation of this specific patient's absolute midline

Fig. 18: The occlusal plane of this patient's existing dental restoration deviates markedly from his natural occlusal plane

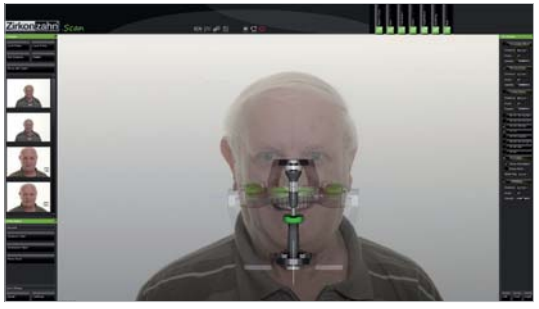


Fig. 19: For maximum realism during the design process …

DIGITAL WORKFLOW

In the Zirkonzahn.Scan software environment, a project is created using CAD PlaneTool PS1-3D, followed by digitization of the mounted cast with the ZIRKONZAHN S600 ARTI scanner (Fig. 16). Data which can be stored in this context include the patient's absolute midline (Fig. 17), the occlusal plane (Fig. 18), and tooth proportions as well as various 2D/3D photographic images (Face Hunter) and cephalograms (Figs. 19 and 20). For well-founded aesthetic matching of the restorative tooth shapes and positions to the shape and gestures of the face, the patient should be depicted in those photographs from different angles

Fig. 20: … it is recommended to use 3D images of Face Hunter (Zirkonzahn)

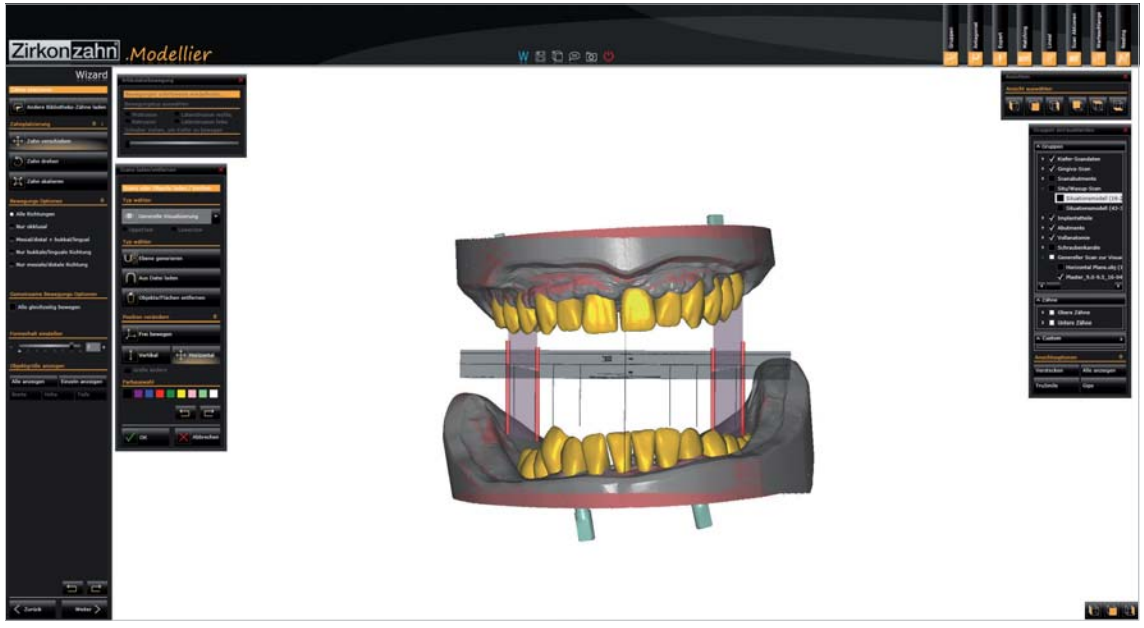


Fig. 21: Occlusal plane (grey) relative to the natural position of the maxilla

and with varying facial expressions (like serious or laughing or smiling).

The next step is to open the project in the Zirkonzahn.Modellier environment. This will make more information (in addition to the photographs) available for the virtual design process, including the position and inclination of the occlusal plane relative to the natural position of the maxilla, whereby the dental restoration can now be related to the natural occlusal plane also in the digital domain (Figs. 21 and 22) and the absolute midline placed relative to the natural position of the maxilla, which may be used as reference for positioning the dental midline (e. g. in edentulous maxillae) to avoid asymmetric loads inside the body (Fig. 23). Starting from the absolute midline, the remaining tooth reconstructions are positioned in their correct mutual proportions, resorting to mean values derived from specifically performed measurements and from the Düsseldorf reference values (Fig. 24).

Fig. 22: Positioning of the dental restoration based on the natural occlusal plane

Fig. 23: Absolute midline relative to the natural position of the maxilla (here vertical line at the contact point of the central incisors)

Fig. 24: Positioning of the remaining teeth, starting from the absolute midline and designing the teeth in correct mutual proportions

CONCLUSION

PlaneFinder® allows measurements and records that have been performed directly on the patient to be handed over to a well-conceived and seamless digital workflow. The PlaneSystem® hardware and software elements used in this process are designed to factor in both function and aesthetics in creating dental restorations.

While exact recording and measuring of each patient's situation will reduce the time for refinements needed to adjust the restoration to the individual requirements, this will not, of course, eliminate the need for direct try-ins in the patient's mouth to check his or her facial expressions (soft-tissue support), aesthetics, phonetics, and function.

Yet by taking into consideration the natural inclination of the occlusal plane on both sides of the dental arch, it should be possible to come very close to achieving the requirements that the dental restoration should meet in the patient's mouth even before the first try-in. Everybody involved can save valuable time in this way.

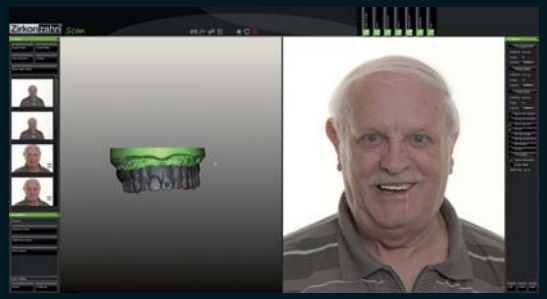
The occlusal plane of the restoration can be repeatedly checked, as needed, for agreement with the natural occlusal plane, both in the digital domain using the software and in the physical domain using the PS1 mechanical articulator. This is a key benefit of the system, considering that even subsequent adjustments to restorations will not always succeed in compensating for a poorly simulated occlusal plane.

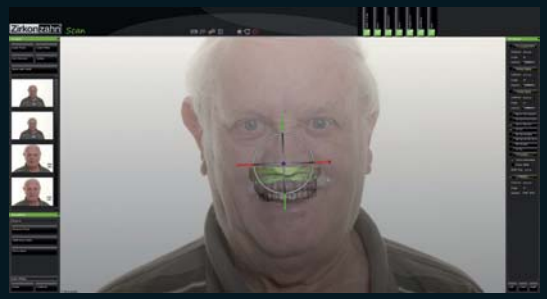
Plaster, Udo/Marlies Strauß: „Funktion trifft auf Ästhetik – im digitalen Workflow." Digital Dental News, 2014 (8), p. 32-38

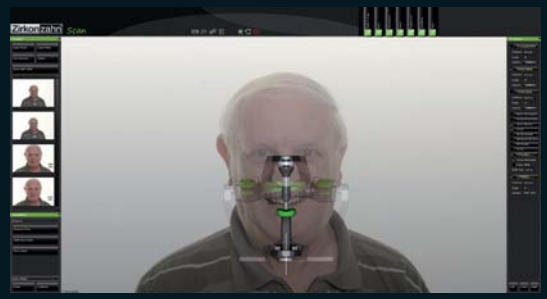
OCCLUSALLY SCREW-RETAINED PRETTAU® BRIDGES ON SIX MAXILLARY TITANIUM BASES AND FOUR MANDIBULAR IMPLANTS WITH A TITANIUM BAR

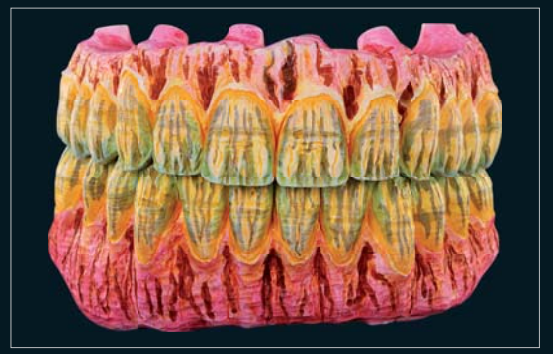
The patient situation was scanned by MDT Udo Plaster using the PlaneSystem® and replicated in an articulator. The first trial set-ups were sent, along with the casts, to Dentallabor Steger for implementation and scanned there. The try-ins were used as the diagnostic cast, and a titanium bar was designed as a reinforcement for the extended cantilevers. The titanium bar was milled in the M1, refined in the parallelometer and polished to a high lustre. After re-scanning the bar, the superstructure was adjusted based on the new situation and modelled. The maxilla, too, was modelled according to the situation and the occlusion tested against the mandibular situation. The work was milled in Prettau® Zirconia and then finished. Cutbacks were made at the front and in the gingival areas. The two Prettau® bridges were stained, dried and sintered in the Zirkonofen 700. Then the restorations were re-fitted on the model, and the occlusion was adjusted by removing premature contacts. The cutback areas on the labial surfaces of the anterior teeth and the gingiva were veneered with ICE Zirkon Ceramics. The final characterization was carried out by applying ICE Zirkon 3D Stains by Enrico Steger and glazing.

Professor Wael Att – University Medical Center Freiburg, Germany
MDT Udo Plaster – Plaster Dental-Technik GbR Nürnberg, Germany – Provisionalization and articulator set-up
MDT Georg Walcher – Zirkonzahn Education Center Bruneck, South Tyrol









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