The 3D Click Guide®; An Analog Fully Restrictive Surgical Guide Produced in 30 Minutes.

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Abstract

The 3D Click Guide® is an analog, fully restrictive surgical guide for 1-2 implant cases. A prefabricated system that is individualized for each implant site. In combination with Mach-Slo™, a dedicated VPS casting material, true same day surgery is attainable.

Introduction

A dental implant is in an object in space, defined by 3 dimensional planes; x, y and z. The same planes in dentistry are described as mesio-distal , bucco-lingual and apical coronal. The ideal position of an implant is within an adequate volume of bone, allowing straight line screw access through the central fossa for molars and in the cingulum for anterior teeth. Positioned deep enough to develop an emergence profile, but not too deep as to create peri-implant pocketing. All while staying clear of neighboring teeth and vital structures. Deviating from this ideal position does at a minimum create restorative challenges, but can be as grave as permanent nerve injuries. So placing an implant does not only require the theoretical knowledge but also the clinical ability to execute a treatment plan.

During conventional free hand surgery the operator develops an osteotomy in all 3 dimensions mentally combining all in one surgical drill path. Guided surgery with a fully restrictive surgical guide requires each of these planes to be considered individually based on various cross sections. A fully restrictive surgical guide can then be fabricated combining each planes trajectory into a surgical guide, which guides bone drills into a restricted singular path[1-13].

The Straumann group has released data showing that in 2012 the average number of implants placed in the USA by dentist placing implants was 50-60.(Straumann, AG, public investor data 2012). So for every dentist placing 500 + implants a year is a large group of clinicians who place only a fraction of that number. The original model where one very experienced clinician received referrals for 20 -30 implants per year from 20 – 30 referring dentists is rapidly changing

We see that a growing number of clinicians are placing implants, but with a lower total number of implants placed per operator. This of course has implications for the surgical skill compared to clinicians placing many hundreds of implant per year. The concern of course is that with less experience the treatment outcome would be jeopardized. We all know that practice makes perfect. But we also know that technologies can help bridge the gap. Guided Implant surgery is the technology that allows less experienced clinicians to place implants exactly in the required 3 dimensional position. Let's be crystal clear; one still needs all the knowledge, there can be no excuse for poor planning, but the surgical execution is greatly simplified.

Fully restrictive guided surgery requires less skill compared to freehand surgery, even in absolute terms it might even produce better result[14-16]. The development of the workforce, more, less experienced, dentists placing implants would make a good argument for fully guided surgery. At the same time controlling the cost of medical care in relation to the outcome will be an issue.

Most dentist at this time are (somewhat) familiar with CAD/CAM produced surgical guides. High tech CAD/CAM produced guides are powered by the data from CT or CBCT and designed in a variety of software products. The actual surgical guides can be printed or milled, all will have round cylinders allowing dedicated

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Fig. 1

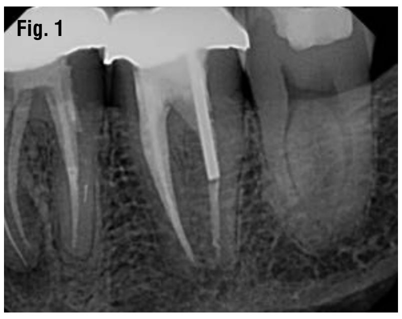



Fig. 2

Fig. 3


FIG. 1: First lower molar with failed endodontic treatment. **FIG. 2:** Immediately after extraction. **FIG. 3:** Three Months healing with mineralization progressing.

Fig. 4

Fig. 5

Fig. 6


FIG. 4: Rope wax extends the tray margins in order to push the soft tissues down. **FIG. 5:** Clinical situation three months post extraction. Note adequate keratinized tissue. **FIG. 6:** Alginate mixed in a stiff consistency captures the mandibular teeth and the edentulous area.

Fig. 7

Fig. 8

Fig. 9


FIG. 7: Mach-SLO™ is injected carefully as to not incorporate air bubbles. **FIG. 8:** The impression tray is moved to control the flow of the VPS material. Fast setting allows the clinicians to build up the material. **FIG. 9:** VPS material is injected into the DVA tray and filled for a 3/4 cast.

Fig. 10

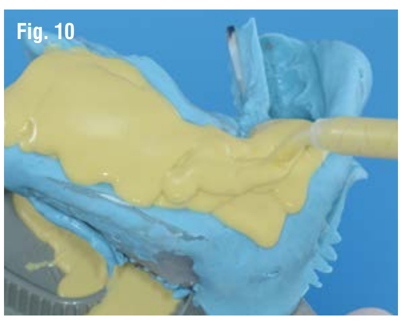



Fig. 11

Fig. 12


FIG. 10: Fresh Mach-SLO is placed onto the now partially set tooth section. **FIG. 11:** Fresh material is also placed on the tray base. **FIG.12:** The impression is lowered onto the DVA tray and the soft materials fuse together.

Fig. 13

Fig. 14

Fig. 15


FIG. 13: 3/4 cast with a repositionable base. **FIG. 14:** The material sets within in 2 minutes, and can be adjusted with a scalpel. **FIG. 15:** A soft and a hard material are vacuform in a dual layer.

Fig. 16

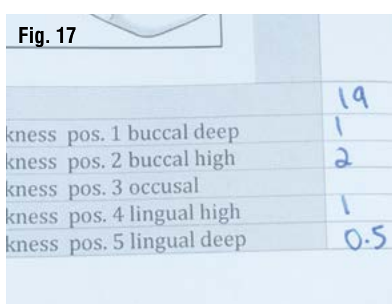
Fig. 17


Fig. 18


FIG. 16: A large scalpel is used to cut the cast. **FIG. 17:** Soft tissue readings are recorded. **FIG. 18:** The readings are transferred to the cast and connected.

instrumentation to be precisely guided, creating the osteotomies and guide the implant during placement. The common denominator is that all need (CB)CT information to feed into the computer. At first to diagnose the situation, second to power the generation of an STL file, which then can be used to produce a guide. Where CBCT undeniably has many advantages, it does bring its own set of issues; cost and radiation. The cost of a CBCT scan at a dedicated imaging center in the author's city is $400 and an intraoral scan is $50, amounting to a cost of $450, just for digital input data. There is limited data in the literature on cost; the fee for a CBCT scan in Switzerland is the equivalent of $300[17]. Ionizing radiation is inherently necessary to acquire a data set. The ALARA principle; as little as reasonably achievable, requires to consider if exposure to radiation does benefit the patient or is merely interesting knowledge. As mentioned, dedicated software can generate an STL file which can be used by manufacturers of CAD/CAM guides to produce a guide. In the US market the main CAD/CAM guide producers currently charges between $300 and $500. This brings the total cost of a CAD/CAM guide to between $750 and $950. This does not include the cost of purchasing the software, yearly maintenance fees, and or the cost of a radiologist reporting. In contrast, the described analog guide does costs $140 per implant site.

When we consider that roughly 80% of all the cases in the world are 1-2 implant cases, (Personal communications Nobel Biocare and Glidewell Dental Laboratory) then many clinicians find the cost of CAD/CAM guides prohibitive for these smaller cases.

To fill this gap and balance the need for a fully restrictive surgical guide and the need to control cost for the smaller cases, the 3D Click Guide® (Idondivi, Inc, San Francisco, CA) was developed.

An in-office cast- based concept, not necessarily requiring CBCT. Although, when judges necessary, it can easily be combined with CBCT information when appropriate. An experienced operator can produce a guide, from impression making to radiographic confirmation, in as little as 30 minutes. When fabricated in-office, true same-day surgery is possible.

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FIG. 19: A Bucco-Lingual Positioner (BLP) as 3 mm markings. **FIG. 20:** The markings are transferred as to place the top of the implant 3 mm below the soft tissue. **FIG. 21:** The center of the implant is marked. **FIG.22:** The marked line is extended. **FIG. 23:** A hole is drilled , signifying the top of the implant at the center of the implant.

FIG. 24: The BLP has an extension which is placed into the hole. **FIG. 25:** The BLP is positioned at the marked line. **FIG. 26:** Contra lateral material is removed to compensate for the thickness of the BLP. **FIG. 27:** The desired Bucco-Lingual trajectory is confirmed for a screw retained access channel. **FIG.28:** Cyano-Acrylate locks the BL position.

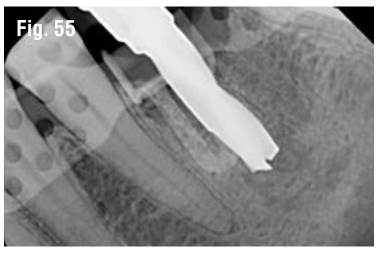
FIG. 29: The casts are reunited into the DVA tray. **FIG. 30:** The buccal wings are fitted to be passive. **FIG. 31:** The lingual wings are fitted and adjusted. The assembly can be move Mesio-Distally for the desired MD position of the implant. **FIG. 32:** Fast setting PMMA , ortho acrylic is mixed. **FIG. 33:** The runny material is applied to cover the wings.

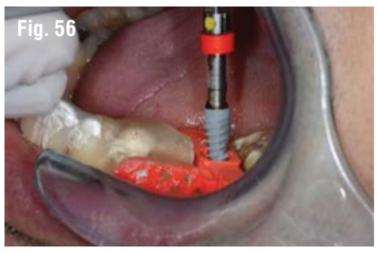
FIG. 34: The acrylic covers the wings and the vacuform. **FIG. 35:** A second batch of acrylic is applied. **FIG. 36:** The occlusal part is also reinforced with acrylic. **FIG. 37:** Upon setting the wings are connected to the vacuform carrier. **FIG. 38:** The cross member is sectioned with scissors.

FIG. 39: The cross member is removed. **FIG. 40:** The finished guide with the retention rails exposed. **FIG. 41:** Three rotation block selections are available. Green 0 degrees, yellow 3 degrees and red 7 degrees. **FIG. 42:** A 0 degree rotation block is clicked onto the retention rails. **FIG. 43:** Completed surgical guide repositioned onto the cast.

FIG. 44: The Radiographic Implant Replicas (RIR'S) are not overlapping, indicting a non-diagnostic radiograph. **FIG.45:** A slight change in the x-ray direction indicated a diagnostic radiograph, and the need to rotate the MD Trajectory toward the distal. **FIG.46:** A red 7 degree rotation block is placed. A metal drill guide shows the resulting rotation towards the ideal trajectory. **FIG. 47:** The X-tip intra osseous injection system created instantaneous profound anesthesia. **FIG.48:** Adequate keratinized tissue allows flapless placement, circular tissue punch in action.

FIG. 49: The tissue plug is removed. **FIGS. 50 & 51:** A starter drill (Nobel Biocare, Yorba Linda, CA) flattens the ridge and creates the first two mm of the osteotomy. **FIG. 52:** A 3.6 mm single cut drill (Blue Sky Bio LLC) is placed into a 3.6mm drill guide. **FIG. 53:** Radiograph is taken 3 mm short of final depth.





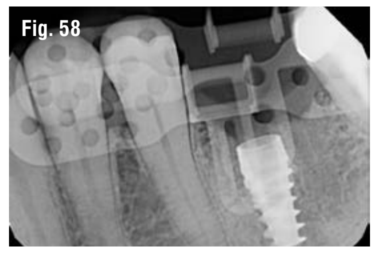


FIG. 54: Osteotomy is completed. **FIG. 55:** Drill at final depth. **FIG. 56:** Nobel Active implant 10 x 3.3 mm ready for insertion. **FIG. 57:** Final insertion with hand wrench. **FIG. 58:** Implant placed at the predetermined position.

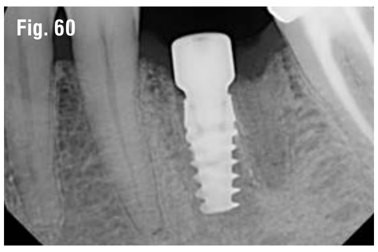


FIG. 59: Intraoral view with healing abutment in place. **FIG. 60:** Post-operative radiograph immediately after implant placement. **FIG. 61:** ISQ test 6 weeks post placement. **FIG. 62:** 79 ISQ, indicative of a tight integration. **FIG. 63:** Radiograph showing some crestal bone remodeling.

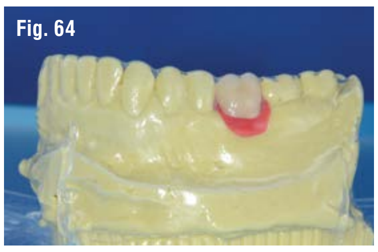


FIG. 64: Cast with denture tooth simulating prosthetic outcome. **FIG. 65:** Soft shell, with PVS putty reinforcement. **FIG. 66:** Provisional metal cylinder shortened to be just out of occlusion. **FIG. 67:** Soft shell is filled with Bis GMA material, seated, PVS putty reinforcement positioned. **FIG. 68:** Screw retained provisional in development.

FIG. 69: Finished screw retained provisional. **FIG. 70:** Screw retained provisional in place, shaping soft tissues. **FIG. 71:** Final screw retained crown. **FIG. 72:** Radiograph at placement of final restoration.

The final product of this system is similar to a computer guide produced using CAD/CAM technology. The fully restrictive guide has a dedicated channel through which drills and appropriate keys can be used to create an accurate osteotomy.

Clinical Technique

- Take an overextended impression to capture the maximum possible of the edentulous ridge. A stock tray is extended by locally applying orthodontic rope wax (Wax square ropes white, Patterson dental company, St.Paul, MN) at the site of interest. In the mandible both lingual and buccal, in the maxilla just buccal. Alginate is mixed in a stiff consistency and the tray is filled. The tray is positioned in the mouth, the stiff wax will push the tissues down exposing the alveolar ridge.
- Place a topical anesthetic on the soft tissue of the edentulous site.
- Measure the soft tissue thickness; 5 readings per implant. Use a 27G Short anesthetic needle (Fairfax Dental, Miami, FL), with an endodontic rubber stopper.
  - Deep buccal = 2mm above deepest point captured by impression captured
  - High buccal = 3-4mm below crest
  - Deep lingual = 2mm above deepest point captured by impression
  - High lingual = 3-4mm below crest
  - Crest , can also be measured from X-ray
- Pour the impression in an Accutrac Precision Die System tray (Coltene/ Whaledent Inc, Cuyahoga Falls, OH or DVA twin trays, (Dental Ventures of America, Inc., Corona, CA) using a VPS casting material (Mach 2 slow, Parkell, Inc. Edgewood, NY).
- Place a denture tooth or wax-up. Mark the buccal gingival outline of the desired prosthetic outcome. The shoulder of the implant should in general be 2-3 mm below this line.
- Create a dual layer vacuform carrier. Use 1mm soft-guard material and 0.75 mm bondable material, heat together (Essix A+ and model duplication material, Dentsply Raintree Essix , Sarasota, FL)
- Cut the cast with a scalpel along the Mesio-Distal path of the proposed MD axis for the implant. The cut is based on an estimation of neighboring roots and the center of the tooth that will be replaced. Use radiograph and anatomical information. Transfer the five tissue thickness readings to the cut face of the cast. Connect the markings parallel to soft tissue.
- Mark the desired BL implant axis on the cast relative to bone volume and wax up. Determine the desired top of implant and then drill a 1 mm diameter small hole at the implant axis. The top of the implant is generally 2-3mm below the buccal gingival outline. This placement will place the top surface of the rotation block 9 mm above the shoulder of the implant. (9 +1= 10mm above the drill-guide). Place the blue Bucco-Lingual Positioner (BLP) in the hole and line up with the drawn axis. Secure with fast setting Cyano-acrylate glue (Instant Krazy® Glue, Krazy Glue, Columbus, OH). Remove some cast material from opposing part of BLP. Place parts of cast back into Accu-trac tray / DVA twin trays or Pindexed cast
- Position the correction slot of Buccal wing on top of the BLP. Cut/bend wings / Radiographic Implant Replica's (RIR's) as needed for a passive fit. Attach and adjust the Lingual wing (White). Position the complete assembly on top of the BLP. Secure the wings and RIR's with a fast setting PMMA ortho-acrylic (Ortho Resin, Dentsply, York, PA) to create an irreversible solid connection. Remove the cross-member, exposing the retention rails.
- Place the surgical guide in mouth. Take a radiograph. If the radiograph is exposed correctly, perpendicular to the ridge, then the images of the two RIR's will overlap and appear as one. This indicates a diagnostically appropriate image. If the trajectory is as desired, no rotational corrections are needed; then a 0 degree rotation-block (green) is selected. If a small correction appears warranted a 3 degree yellow rotation block is selected. A larger correction is possible, by selecting a 7 degree, red rotation block.
- Depending on the manufacturers drilling protocol a small diameter initial drill is selected. Drill with the 2.0 mm pilot drill to a short and safe depth and evaluate the length of the osteotomy. The top of the rotation block is 9mm above the top of the implant. The drill guide is 1mm thick, so the drill stop should be set at + 10mm for accurate depth control. For example a 10mm osteotomy requires the drill-stop to be set at 10+10 = 20mm. The final length of the implant can then be determined and the osteotomy can be prepared to length. Subsequent drills of larger diameter are employed to widen the osteotomy as required.
- The implant can now be placed with guidance and depth control.

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