

How to achieve satisfactory results when dealing with biological limitations? The interface between specialties to allow for the best clinical solution

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Abstract: Nowadays, aesthetic requirements of our patients are very high. This is encouraged by media consumption, in which models with perfect white smiles are shown to the public as references of beauty. In cases in which biological reconstruction is no longer possible, in order to achieve a result of excellence, it is necessary to create interdisciplinary alternatives

that can solve the treatments. Therefore, the technological evolution guided by scientific researches has brought to dental market different possibilities and ways to solve complex and limited clinical cases. Different regenerative techniques (both of hard and soft tissues) have their limitations – which at times, do not fulfill the aesthetic needs of the case, consequently, demand-

ing the use of prostheses that can copy the actual structures as naturally as possible. For these complex cases in particular, dentogingival prostheses are an alternative to tissue reconstruction. **Keywords:** Interdisciplinary team. Orthodontics. Dental implants. Bone graft. Ceramics veneers. Dentogingival prosthesis. Gingival smile.

INTRODUCTION

Even with an interdisciplinary Dentistry and increasingly advanced and predictable techniques, there are cases that cannot be solved by naturally returning the lost anatomical structure. Those cases often pose a limitation to the procedure, in which the structures involved will not respond in a satisfactory and predictable way to the process.

In such cases, diagnosis and planning are imperative so that, even knowing about such limitation, patients are aware of the efforts made and do not create false expectations due to promises that often may not materialize. This can lead to a high level of dissatisfaction and insecurity, damaging the relationship with the patient. The decision on which way to go, therefore, begins with the agreement or not between the patient and the professional regarding the type of treatment proposed.

The aesthetic component is based on two main pillars: red esthetics (gingiva) and white esthetics (teeth). Thus, if the limiting factor is the absence of red esthetics - whether due to horizontal or vertical bone defects or gingival recessions - it is necessary to return the red esthetics by means of tissue reconstructions or in an artificial (prosthetic) way, using implant-supported or tooth supported dentogingival prostheses, restoring the optimal proportions between the aesthetic determinant components.

For this communication to have an excellent result, both in the functional and aesthetic aspects, a highly qualified DPT must be part of the team, both in the planning of the case and in the execution of the appropriate procedures. The soft tissue / prosthesis integration should be as natural as possible to mimic and soften that interface, as well as facilitate patient hygiene.

CASE REPORT

Planning Phase

A 36-year-old female patient attended the clinic with an aesthetic complaint related to tooth #22, which presented a gingival margin out of position (Fig 1A-1F).

After the first consultation protocol - which consists of anamnesis, video, clinical examination, photographs, moldings and periapical radiographs -, diagnosis and the planning were carried out.

Regarding the diagnosis, it was verified:

- Deviation from the lower middle line to the left;
- High (gingival) smile originating from the vertical maxillary excess and hypermobility / hyperactivity of the lips;
- Standard Class II: Jaw slightly retruded, but with harmonious profile;
- Dental Class II of canines and molars;
- Sharp Curve of Spee;
- Protrusion of inferior teeth;
- Discreet maxillary and mandibular anterior crowding;
- Lack of space for tooth #12; and
- Implant poorly positioned, in the #22 tooth region.

Through this survey, the planning consisted of an explantation of #22 and bone graft removed from the maxillary tuberosity (performed by Dr. José Carlos Martins da Rosa)¹⁵; installation of maxillary and mandibular fixed appliances for alignment and leveling of dental arches; and orthognathic surgery to correct the maxillary vertical excess and, consequently, reduce the gingival smile (Fig 1G-1I). After the bone graft healing, a provisional implant was made in the region of element #22 to aid in orthodontic movement and planning.

When the patient was told she was ready for orthognathic surgery, she gave up. Thus, after a



Figure 1: Initial intraoral and extraoral photos, and explantation #22 with bone graft: **A)** Frontal extraoral smile; **B)** half profile of right side smile; **C)** half-profile of left side smile; **D)** frontal close-up smile; **E)** half right profile close-up smile; **F)** half left profile close-up smile **G)** Explantation of #22; **H)** bone graft removed from the maxillary tuberosity; **I)** installation of the fixed appliance and the provisional #22.tooth

44

restudy, maxillary impaction with miniplates was suggested for bone remodeling, improvement of the gingival smile and positioning of the gingival margins, as an alternative to orthognathic surgery.

Orthodontic phase

The three-dimensional diagnosis has been proved very efficient and presents great ad-

vantages in relation to the two-dimensional diagnosis. Cone beam computed tomography (CBCT) was introduced in Dentistry in 1998¹² and has shown to be advantageous in relation to radiographs for generating dynamic, sharper images without overlaps. Moreover, the original data set can be reformatted to reproduce the images typically obtained on conventional

radiographs, while the radiographs are only a static image, which cannot be altered.⁵ In radiographs, it may be difficult, or even impossible, to verify pathologies related to the condyles because the image is distorted and fails to illustrate the true morphology of the mandible;⁴ meanwhile, the tomography depicts the actual shape of the structures.

The radiation from the CBCT is greater than that of conventional radiological examinations, but the dose is not high if compared to that of a medical

computed tomography.¹¹ The radiation dose of the CBCT is similar to the dose a passenger receives during a return flight between Paris and Tokyo.²

The SYM 3D® protocol is the tomographic diagnostic method chosen for the application of the Ertty Systems mechanics.¹⁶ This systematic protocol provides craniometric analysis by means of linear and angular measurements that make it possible to interpret and correlate the morpho-functional alterations with the malocclusion and the condylar position of patients.³

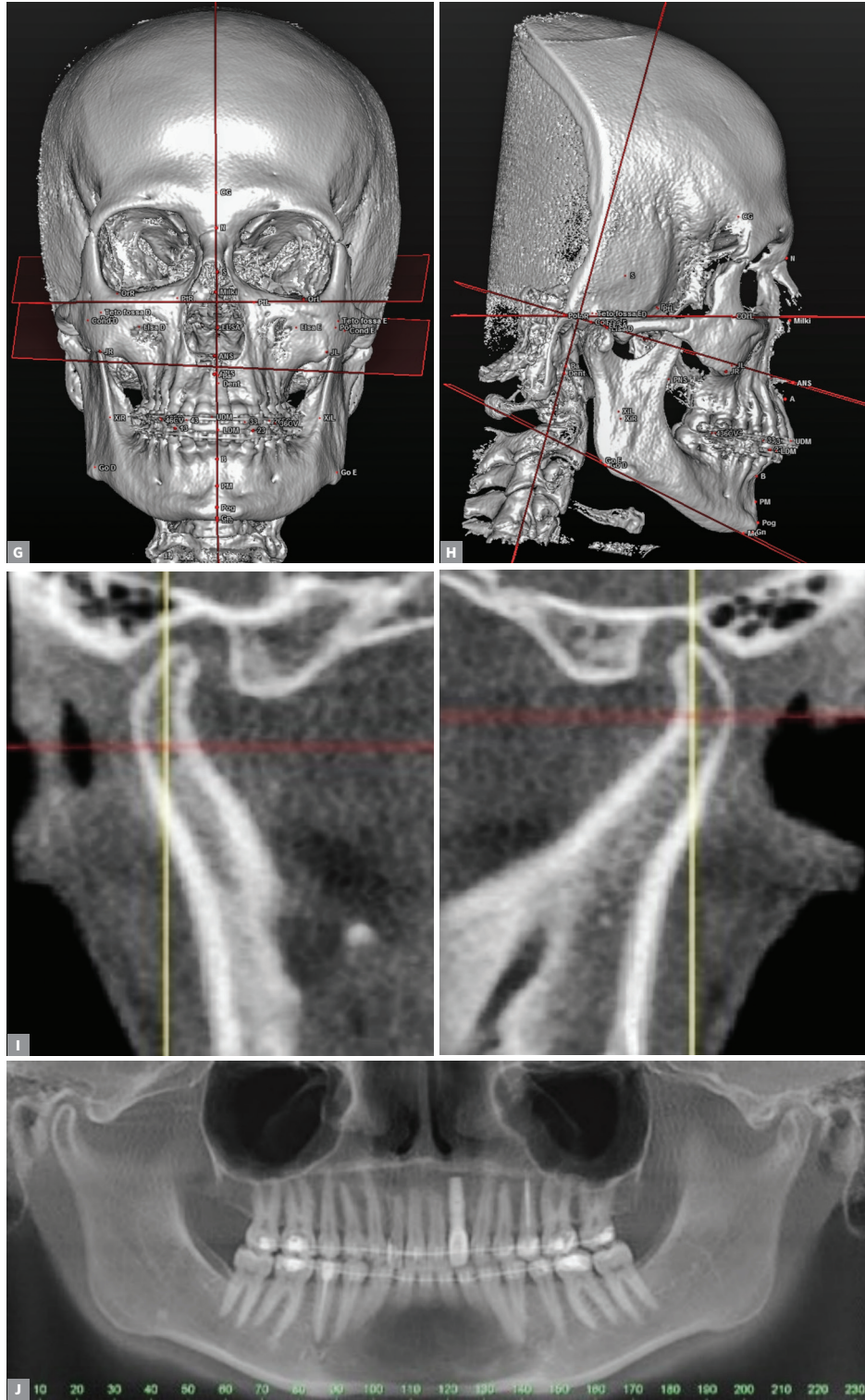
PROBLEMS (FIG. 2A TO 2J)			
SAGITTAL	TRANSVERSAL	VERTICAL	OTHERS
Class II	Triangular upper arch and parabolic lower arch	Dolichofacial (mild)	Implant in the region of #22
Slightly protruded maxilla and slightly retruded mandible	Lower dental midline deviated to the left and upper deviated to the right	Sharp maxillary growth - gingival smile	Upper and lower anterior crowding
Well positioned upper incisors and buccalized inferiors			
Condyles to posterior in the joint cavities			
Diagnosis: Skeletal Class II and sharp vertical maxillary growth			

TREATMENT (FIG. 3)			
SAGITTAL	TRANSVERSAL	VERTICAL	OTHERS
Distalization of the upper posterior teeth (greater on the left side) and lower (greater on the right side)	Upper dentoalveolar expansion	Maxillary impaction and / or maxillary bone remodeling	Explantation of tooth #22
Retraction of upper and lower incisors	Correction of the lower midline deviation through a greater lower right posterior distalization		Installation of six miniplates (four upper and two lower)
Maintenance of the condylar position, due to the positioning of the articular disc, which was displaced anteriorly, with reduction, bilaterally.	Correction of the upper midline deviation, through a greater left upper posterior distalization		Gaining of space for the upper incisors and for the verticalization of the lower incisors, through the distalization of posterior teeth



46

Figure 2: Extraoral and intraoral photographs, and SYM initial protocol: **A)** frontal extraoral smile; **B)** right lateral intraoral; **C)** frontal intraoral; **D)** left lateral intraoral; **E)** upper occlusal; **F)** lower occlusal; **G)** anteroposterior view of 3D reconstruction; **H)** right lateral view of 3D reconstruction; **I)** approximate view of the condylar position; **J)** panoramic view generated from the tomography.



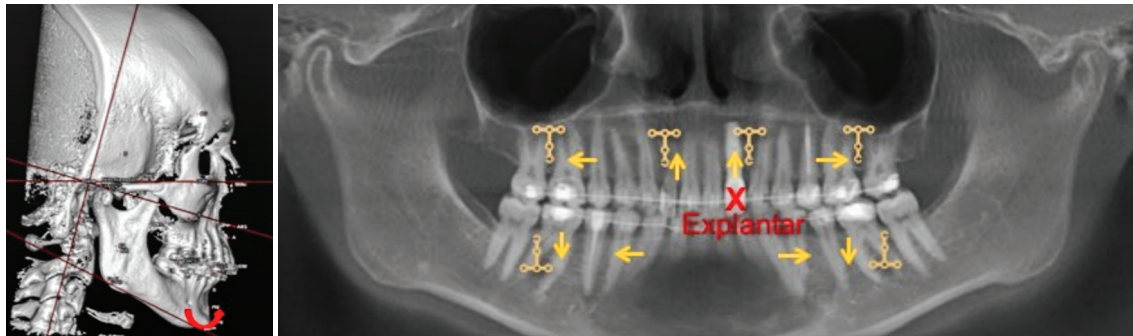


Figure 3: Planning of the proposed treatment.

The orthodontic treatment started by installing the upper and lower fixed appliance (Ricketts prescription, slot 0.018 “ x 0.030”). After the assembly of the device, two upper and two lower miniplates were installed, and the implant in the tooth region #22 was explanted to enable maxillary impaction, retraction of the anterior teeth and correction of the upper midline. However, this orthodontic mechanics would not allow the formation of papilla in the region of teeth #21/22 and #22/23.

Next, the dental alignment and levelling and the teeth activation on the miniplates followed. In the lower arch, bilateral cursors were inserted to distalize the posterior teeth; in the upper arch, a cursor was installed on the left side and a cantilever on the right side to distalize the left upper posterior teeth and keep tooth #13 in position as an open coil spring was placed between teeth #12 and #13 to correct the upper midline deviation. Simultaneously, the vertical upper posterior control

was being performed (Fig 4A-4C).

Subsequently, the anterior upper miniplates were installed to make the upper anterior vertical bone remodeling, and an open coil spring was placed between the teeth #33 and #32 to help correct the deviation of the lower midline (Fig 5A-5C).

The arches were coordinated, the occlusal adjustments were made and the apparatus was removed (Fig. 6A-6F). The malocclusion and midline deviation were corrected, and an improvement in the positioning of the gingival margins; in addition, the final SYM protocol illustrated the improvement in the positioning of the lower incisors and the maintenance of the condylar position (Fig 6G-6J). The patient was referred for oral rehabilitation to obtain a prosthetic and aesthetic solution for the lack of papilla between the teeth #21/22 and #22/23.

48



Figure 4: Correction of the upper midline and lower anteroposterior bone remodeling: **A)** right lateral intraoral, **B)** frontal intraoral, **C)** left lateral intraoral.

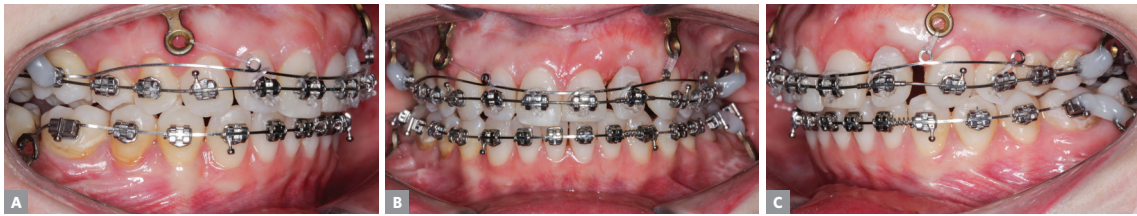


Figure 5: Upper anterior vertical bone remodeling and lower midline correction: **A)** Right lateral intraoral, **B)** Frontal intraoral, **C)** Left lateral intraoral .



Figure 6: Final extraoral and intraoral photographs and final SYM protocol **A)** frontal extraoral smile, **B)** intraoral right, **C)** frontal intraoral, **D)** left lateral intraoral, **E)** superior occlusal, **F)** inferior occlusal.

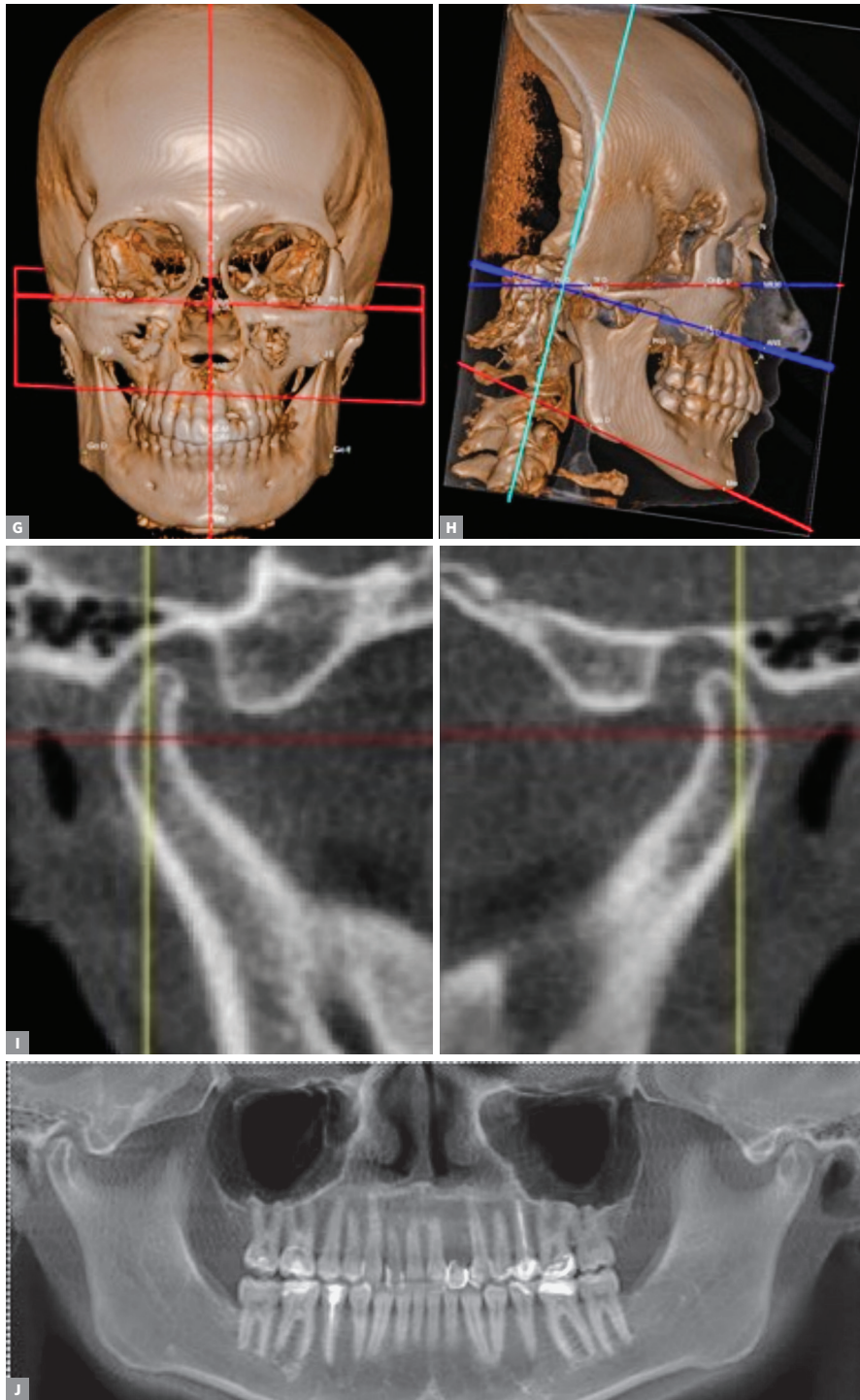


Figure 6 (continuation): **G**) Anteroposterior view of 3D reconstruction; **H**) right lateral view of 3D reconstruction; **I**) approximate view of the condylar position; **J**) panoramic view generated from the tomography.

Prosthetic phase: *mock-up* and prepare

After orthodontic completion, the aesthetic or prosthetic phase started, meaning it would be a new patient. For this, a new photographic protocol, new moldings, facial arch and imaging tests were carried out for the elaboration and programming of a new treatment plan.

Within the re-study, it was verified that one of the patient's main complaints - in this case, the gingival smile - was corrected during the orthodontic phase through the impaction of the maxilla with the help of miniplates.

Due to good dental positioning and a stable and balanced occlusion, the treatment was focused only on the white aesthetics and the return of the papilla between teeth #21 and #22.

The diagnostic wax-up of elements from #13 to #23 was then performed, reestablishing proportion, shape and balance of the functional guides.

Then the *mock-up* started, which consists on the transfer of the diagnostic wax-up to the mouth, using a wall of silicone and bis-acrylic resin. Once restorative test was approved, both aesthetically and functionally, it was used as a guide for a correct three-dimensional installation of the implant in the region of element #22 - in which immediate loading was performed thanks to the primary stability achieved in the surgical procedure (Fig 7A-7I).

After the period of osseointegration, the preparation phase began. Within the current concept (where space and insertion axis are needed for future restorative material)⁹, conservative preparations were carried out, always having the *mock-up* and the palatine and vestibular walls as reference. By means of a double step molding in addition silicone, the position of the implant was transferred along with the preparations (Fig 8A-8E).

Laboratorial phase

Cases that involve implants in aesthetic areas need a careful approach, since special attention should be paid to the transition zone between red and white esthetics, respecting the concept of the critical and subcritical emergency profile of the prosthetic abutment (Fig 9A-9C), which will ensure a correct accommodation of the gingival tissue, thus ensuring health, aesthetics and long-term stability.

This approach is even more delicate in cases where the patient's smile is large and has considerable gingival exposure. In the case reported here, there was one more aggravating factor: when the papilla was observed between teeth #21 and #22, it was too high compared to the others - which completely compromised the aesthetics.

As this correction could not be surgical, the solution was prosthetic, with the addition of a ceramic papilla in the crown of element #22 (Fig 9D). Another tip is the application of an opaque ceramic dentin layer in the coronal third and first intrasulcular millimeter of the abutment in order to render the surface acid-sensitive, which facilitates the adhesive process of cementation of the ceramic crown on the abutment and also adds fluorescence to zirconia (under black light), causing it to have a more natural integration with the cervical portion of the crown.

The ceramic applied to the zirconia butment pillar must be compatible with the thermal expansion coefficient (TEC) of the infrastructure, so that there is a union between the materials. The e.max Ceram was then selected in the color "Deep Dentin A3" as it is closer to the coloration present in the dental remnants of adjacent teeth - planning that facilitates the optical integration of contact lenses, due to the different behavior of opacity levels between the preparations.

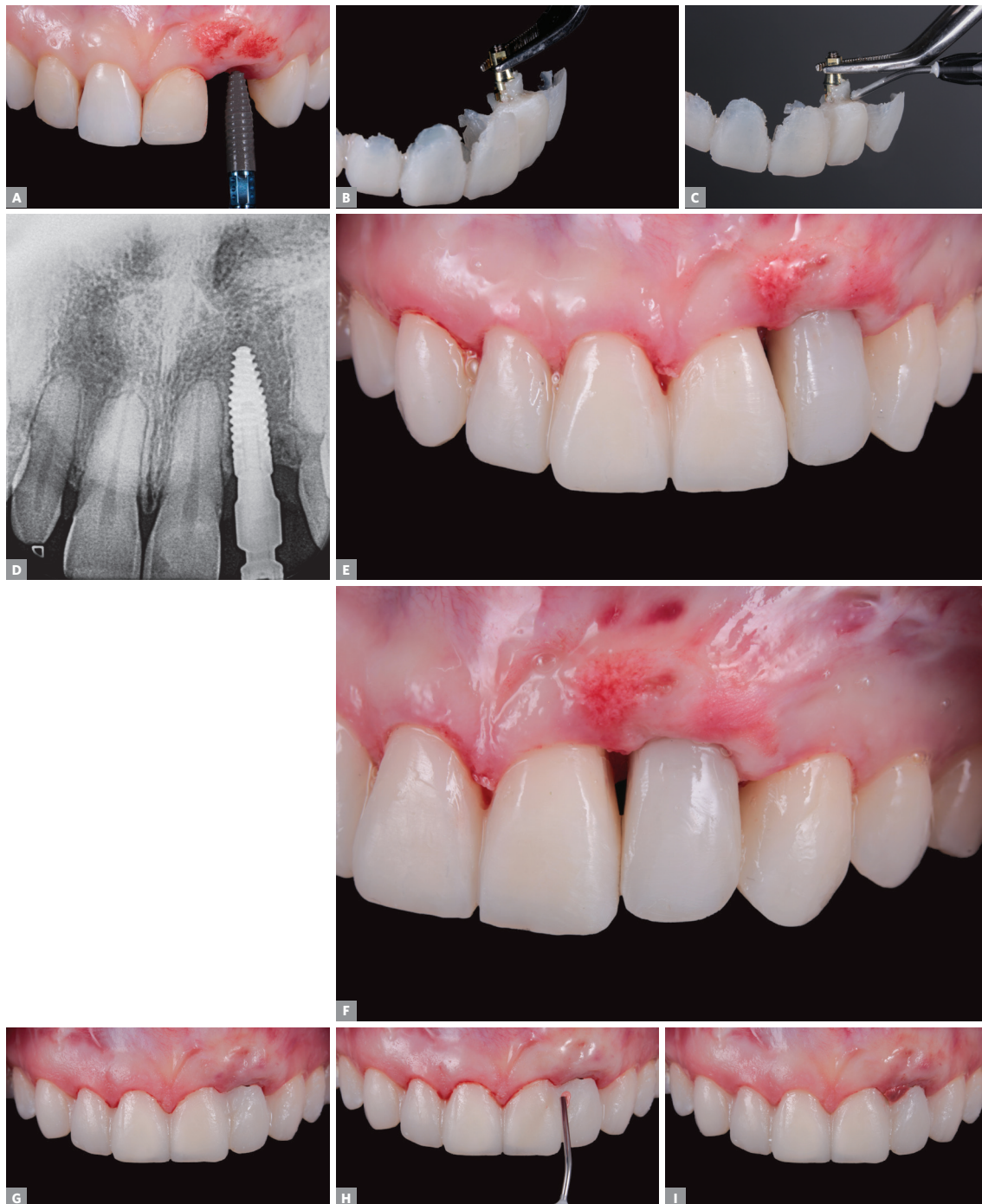


Figure 7: Aesthetic / functional restorative test and guide for implant installation in tooth region #22: **A)** implant being installed; **B)** immediate loading, using the *mock-up* as a guide; **C)** relining for the creation of critical and subcritical profiles; **D)** periapical radiography of the implant installed; **E)** *mock-up*; **F)** approximate view of the defect between #21 and #22; **G)** space closure with *flow resin*; **H)** application of gingiva-colored *flow resin*, for papilla creation between #21 and #22; **I)** papilla simulation between #21 and #22.

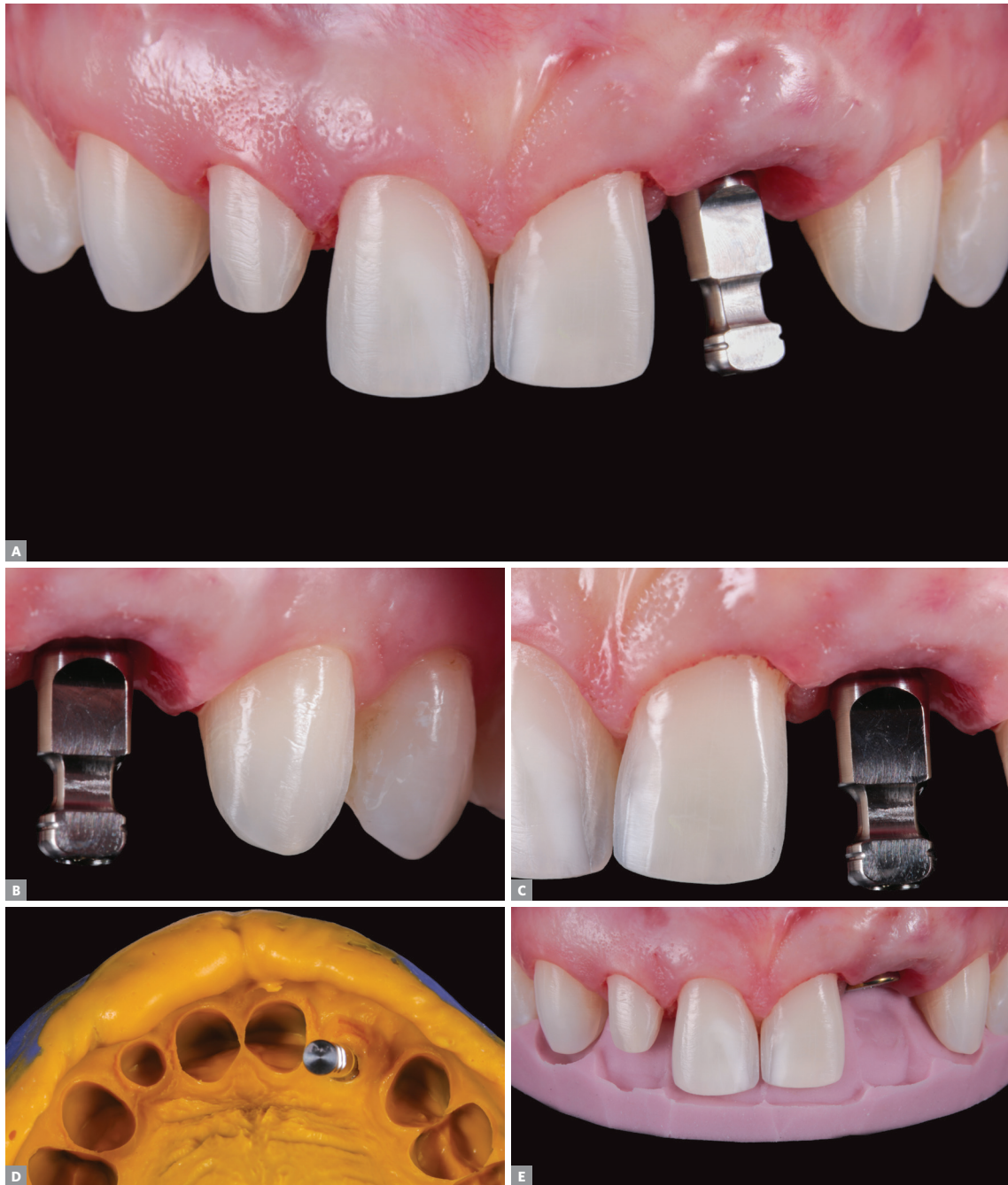


Figure 8: Prosthetic phase: **A)** preparation; **B)** approximate view of the preparations; **C)** finished preparations, after finishing and polishing; **D)** double step molding in addition silicone to transfer the position of the implant and preparations; **E)** palatine wall as reference in the preparation stage.

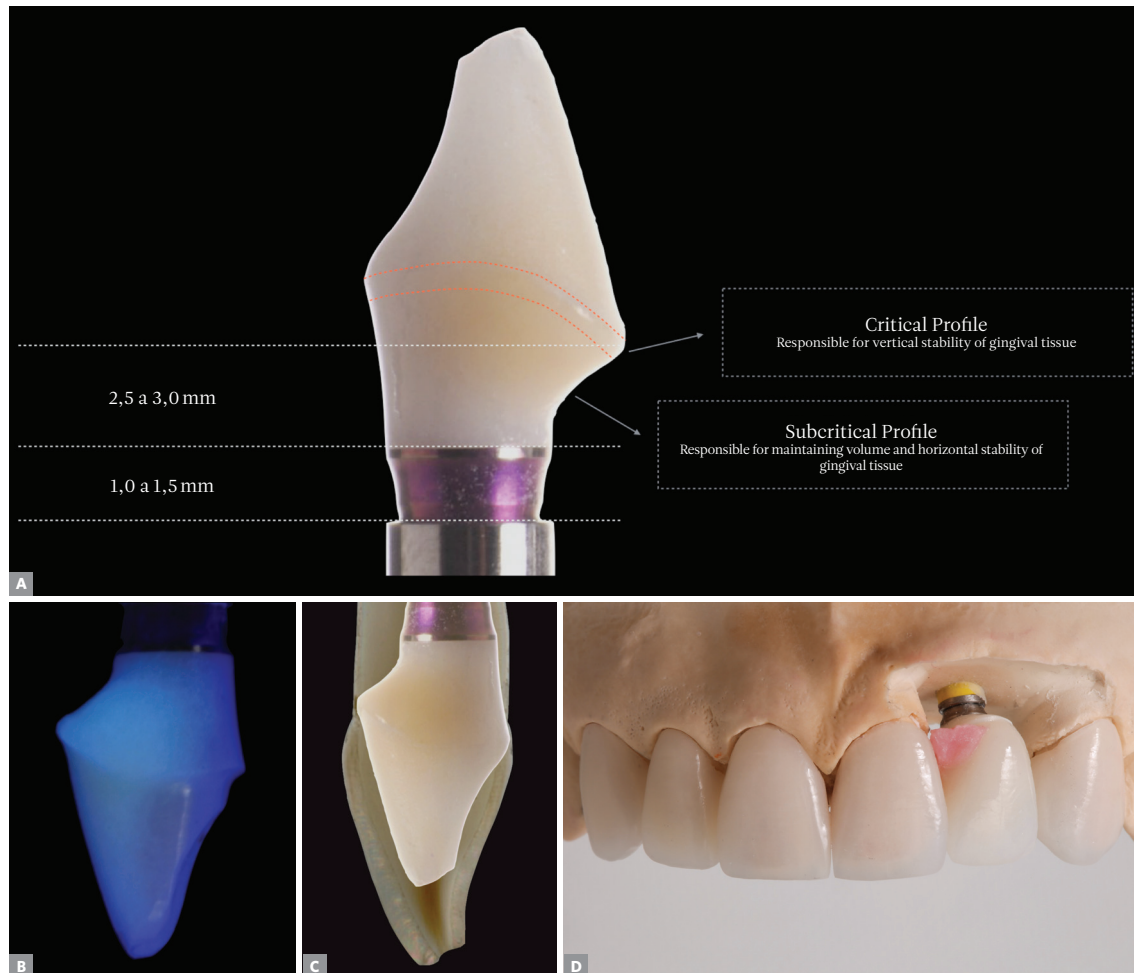


Figure 9: Laboratory phase: **A)** critical and subcritical profiles; **B)** fluorescence under black light; **C)** three-dimensional planning of the personalized abutment, based on natural teeth; **D)** ceramic restorations on the cast model, and adding ceramic papilla on the crown of element #22.

54

Upon completion of the trunnion, it should be screwed in the die model and proceed with the duplication process in addition silicon to then obtain the refractory model.

With the refractories in hand, the application of the IPS ceramics d.SIGN for layering started. For the cervical third, “Dentin A2” was used; for the body of the teeth, ‘Dentina A1’; and for the incisal third ” Opal Effect 1 “- always attentive to the project of the diagnostic wax-up,

which is verified tirelessly, with the aid of the wall of silicone.

After the conference of the result of that first burn, “ Opal Effect 2 “as a cover enamel was applied, giving the restorations translucency and opalescence and also the finishing of the desired morphology.

Diamond drills of fine granulometry and rubbers were used in the finishing and texturing phases of the surface, seeking naturalness in the restorations.

After the glaze burn, the restorations should be carefully removed from the refractory dies with aluminum oxide jets at low pressure (max. = 2 bar) and seated in the master model. For the manufacture of ceramic pieces

always two models of cast were used as standard: one from the first casting, to be stamped; and another to be kept intact, in order to confer the interproximal and occlusal contacts and the gingival architecture.

E. MAX CERAM BURNS ON ZIRCONIA:
- Wash Bake: B 403 ^{or} - C 06:00 - t 50°C/min. - T 780 ^{or} C- H 01:00min. - V1 450 ^o C- V2 709 ^o - L 0.
- 1 st e 2 nd Burnings: B 403 ^{or} C- S 06:00 - t 60°C/min. - T 765 ^{or} C- H 00:30min. - V1 450 ^{or} C- V2 764°C - L 0.

IPS D.SIGN BURNS ON REFRACTORY:
- Wash Bake: B 403°C - S 10:00 - t 55°C/min. - T 930°C - H 01:00min. - V1 450°C - V2 929°C - L 0.
- 1 st Burning: B 403°C - S 10:00 - t 60°C/min. - T 905°C - H 00:30min. - V1 450°C - V2 904°C - L 0.
- 2 nd Burning: B 403 ^{or} C - S 10:00 - t 55°C/min. - T 895°C - H 01:00min. - V1 450°C - V2 894°C - L 0.
- Glaze: B 403 ^{or} C - S 06:00 - t 55°C/min. - T 865C ^o - H 01:00min. - L 0.

Prosthetic phase: conventional adhesive cementation

Once the laboratory's work was received, the cementing consultation began with the dry and wet tests of the ceramics. The dry test, aided by radiographic examinations, allows a visualization of the correct adaptation of the pieces and of characterizations such as surface textures, areas of light reflection and absorption, emergency profile, among others. Already in the wet test, one has an idea of how the ceramics will behave optically using a neutral cement. Currently, cements capable of altering the value of the restoration are on the market, and it is at

this stage that the most appropriate choice of cement is made (Fig 10A).

Simultaneously, the custom *abutment* was tested, checking its adaptation and the support given to the tissue, according to the critical and subcritical profiles. It is important to note that at this stage, there should not be exaggerated compression causing tissue ischemia, or there is a change in the height of the gingival margin achieved in the *mock-up* (Fig 10B).

In this specific case, a neutral or zero value resinous cement was chosen for a conventional adhesive cementation, both on the teeth and on the personalized abutment.



56

Figure 10: Cementation: **A)** trying ceramic restorations; **B)** trying personalized abutment.



CONCLUSION

1. The diagnosis/planning is the most important and essential step of a treatment. This step requires time, attention and the evaluation of a qualified multidisciplinary team.
2. Maxillary impaction with miniplates is effective in bone remodeling and improvement of the gingival smile and positioning of the gingival margins.
3. Cases involving implants in aesthetic areas need caution, since special care must be taken with the transition zone between red and white aesthetics.
4. The concept of the critical and subcritical emergency profiles of the prosthetic abutment will allow an adequate accommodation of the gingival tissue and guarantee health, esthetics and stability in the long term.
5. Dental prostheses are an alternative in cases where tissue reconstruction is not effective.

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