

Stomatognathic system rehabilitation: “the gnatological pre-treatment”

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The case report shows the need for proper “gnatological pre-treatment” to be taken in any dental treatment plane, especially where the functional rehabilitation of the stomatognathic joint system is necessary. The re-coordinated movement of TMJ, the resolution of the joint block and of the reciprocal and bilateral click, result in a clear improvement of either mouth opening, both stability in occlusion centric and eccentric movements.

The relationship between occlusion and TMJ has long been the focus of important discussions in the national and international scientific field (1-5). The role of orthodontics is fundamental to contribute to the correct development of the maxillary bone bases during the patient's growth, therefore the TMJ, except for the presence of congenital structural anomalies, will follow this positive evolution in case of harmonious development of the jaws.

In the adult patient, before going through orthodontic treatment, the orthodontist must be fully aware of the joint condition of the patient who is about to treat. Hence the concept: TMJ dysfunction must be considered on the same level as malocclusion. We will not be able to say that we have solved a case of malocclusion in an adult patient if we have not first treated the condition of the TMJ. Therefore, we wanted to describe our approach of “gnathological pre-treatment”, which precedes any subsequent rehabilitation treatment in the adult subject. The concept of dental rehabilitation to a re-evaluation at the end of the growth, or in any case in the adult subject, cannot be separated from a rehabilitation of the joint function (6-10).

During our dental practice it is common to meet patients who demonstrate signs and symptoms of different pathologies of the oral cavity and of the stomatognathic system. At a careful clinical examination with gnathological evaluation, we focus on the function of the temporomandibular joints, on the action of the masticatory muscles, as well as on the periodontal and dental state, also using the latest generation diagnostic imaging and ultrasound for the study of joint movement.

The presence of dental or skeletal malocclusions, dental wear, fractures, migrations, caries and neck injuries, gingivitis, periodontitis etc., and clicks or joint noises and various symptoms such as tinnitus, buzzing, dizziness, bruxism, headache, and muscle pain associated with muscle tension pathology with difficulty in opening and closing and during the movement of the mouth, places our clinical attention towards the search for the triggering causes (11-14). The concept of dysfunctional patient also includes patients in whom the aforementioned alterations suffered over time by the dental elements and the periodontium (dental wear, fractures, migrations, caries of the neck, gingivitis, periodontitis) are the

Key words: gnathological pre-treatment, dental malocclusions, TMJ

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0393-974X (2022)

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expression of an adaptation of the stomatognathic system to perform functional work, even in conditions of pathology of the mandibular movement (15-20).

The ultimate purpose of a careful functional analysis of the occlusal relationships is to obtain dental elements that have a shape and a position such as to allow a physiological movement of the temporomandibular joints, led by the action of the relevant muscle, to obtain shapes capable of supporting the muscular load exerted in the specific moment, that is when the contact between the arches occurs. As Harry Sicher teaches us “when muscle and bone fight, muscle never loses”, and as Peter E. Dawson confirms “when muscle and tooth fight, muscle never loses” (21-23).

The introduction of an alteration in the shape or position of a tooth can appear as an interference to the patient’s usual occlusion up to that moment.

If a new reconstruction or coronal shift of the position of an element is configured, this involves a change in the occlusion and therefore in the movement of the mandible as a whole by adaptation (24-27). The interference during the instinctive movement of swallowing determines a pre-contact capable of changing the occlusal relationship. Thus, the alteration, however due to a malocclusion, can occur in a distributed manner over time and therefore can chronically alter the muscular articulation functions.

In the case of reconstructions or of restorations or of orthodontic movements, it can take place more quickly and thus destabilize the usual occlusion immediately. This also implies a change in the joint, a dislocation of the meniscus, a change in the action of muscle fibers as a contracture, a change in the shape and position of the teeth, resulting in an altered work of the temporomandibular joints (28-32). The temporomandibular joint is a third-degree lever, therefore unfavorable (33-35), so that the three components of strength, fulcrum and resistance must be well positioned to perform its task.

As part of the resistance exerted on the teeth, the lever must be unfavorable otherwise our muscles would be able to fracture the teeth (36-40). Since the most unfavorable point of support of the lever during lateral movements cannot be exerted on the posterior teeth as they are located in a position between

the fulcrum and the power, and since the teeth of the anterior group serve to guide the movement protruding of the mandible, the teeth most suitable for expressing eccentric movements are the canines, which determine canine guidance (41-44). The latter avoids the contact of the posterior teeth in lateral movements by determining the first phase of the chewing movement, guiding the movement of the jaw until the end of the chewing movement, then up to closure, allowing the posterior elements to meet the cusps of the upper teeth with lower teeth (45-48).

In fact, the very shape of the back teeth shows that they are responsible for shredding. So, their contact, following the slipping caused by the canine guide, allows the chewing cycle to be terminated with adequate shredding of the food (49-51).

Therefore, re-establishing the shapes and functions of the dental elements is a pre-eminent condition to obtain the re-coordination of the joint movement, therefore the repeatability of the function expressed by the teeth muscles and the temporomandibular joint, such as to allow the physiological stability of all the districts: muscle, joint, bone, periodontal, and also of the integrity of the teeth themselves and guaranteeing occlusal stability over time without the need for any orthodontic retention aid. In the light of the evident presence of many of the symptoms and effects already mentioned, our clinical case demonstrates the need to carry out what we define as “gnathological pre-treatment”, conceived from our clinical experience, to be adopted in the context of any dental treatment plan.

The “gnathological pre-treatment” is proper especially in cases where it is necessary to rehabilitate the joint function of the stomatognathic system of our patients, ie in dysfunctional patients. We use an acrylic resin plate as a support, for upper or lower arch, appropriately modeled, by an adequate and suited forms of teeth, on which our patient can perform proper movements with the chewing muscles. In this way we can obtain the desired articular position of centric relationship, the only stable and repeatable situation over time, able to make our work appropriate (52-56).

We present the case of a 48-year-old male patient with alterations characterized by severe wear and dental migration (fig. 1). In addition the patient complained of muscle pain and difficulty in chewing,

buzzing, dizziness, headaches with recurrent tingling of the right limbs and tinnitus. At our clinical observation we highlighted the presence of: midline deviation, absence of dental elements, presence of several prosthetic and conservative restorations, gingival recessions, posterior right open bite and increased overjet.

On palpation of the chewing muscles, pain is evident, localized on the: external pterygoid muscle, internal pterygoid muscle and right masseter muscle. This is a clear symptom of a contracture, that also involves the sternocleidomastoid muscle, with recurrent tingling of the right limbs. The auscultation of the joint highlights a mutual click in both joints, greater on the left. During the opening movements, the click first arises to the left and then to the right and is reduced first to the right and then to the left. Analyzing the mandibular movements, a lateral deviation towards the right of the mandible in the opening of the mouth was noted.

Thanks to gnathological therapy, following careful mandibular manipulation, we detected the presence of a left posterior occlusal interference, responsible for the abnormal conduction of mandibular movement, joint block and reciprocal and bilateral clicks. We therefore diagnosed the presence of a temporomandibular joint dysfunction, associated with dental malocclusion.

Therefore, we are faced with a reducible intra-articular pathology, associated with a condyle-disc incoordination and a tension muscle pathology. We can appreciate noises from structural irregularity due to deformation of both articular discs, not associated with an arthrosic process, so state no MRI examination is required. The case is part of the intracapsular disorders that are not reversible, but because of adaptive changes, can function comfortably if occluso-muscle harmony is re-established (57-59).

Alginate impressions of both dental arches were taken and cast with type III gypsum. Moreover starting joint registrations were taken, using a deconditioning

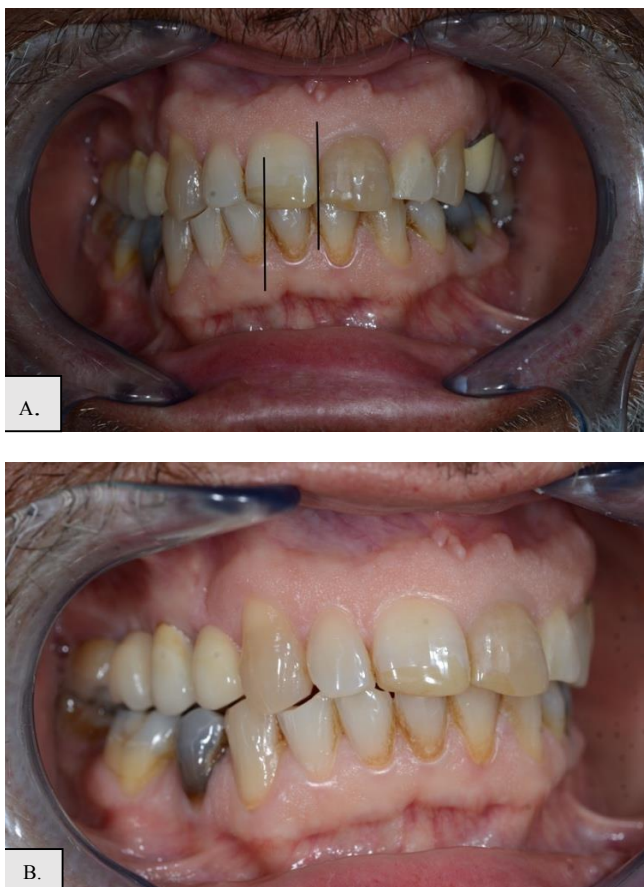


Fig. 1. A, B, C): Pretreatment intraoral images

maneuver so tending to a more stable and repeatable joint position. A face bow recording and an ultrasonic axiography was performed (Fig. 2).

Thanks to the detection of the face bow and the joint recordings, the plaster models were mounted on an articulator at average values (Fig. 3).

Based on the assembly in the articulator, an acrylic resin brace was made with hinted tooth shapes. Subsequent models are carried out in the chair directly on the brace worn by the patient while exercising the functional protrusive and lateral movements. Using our gnathological brace (fig. 4), morphologically customized on the patient in subsequent sessions, we can obtain, through the modeling of stylized tooth shapes but increasingly suitable for the correct conduction of the mandibular movement,

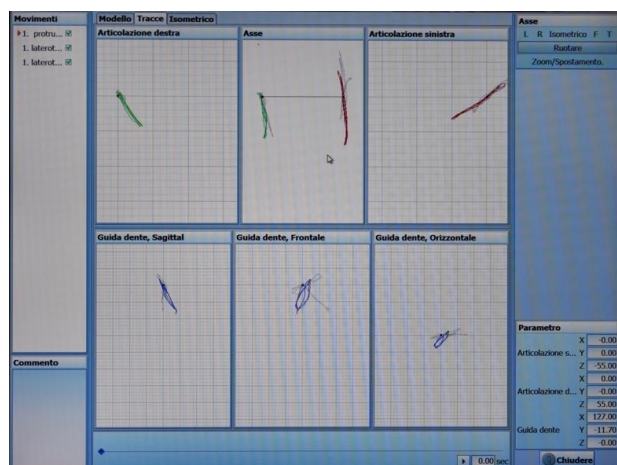


Fig. 2. The axiographic exam shows abnormal conduction of mandibular protrusive movement and joint block and reciprocal and bilateral clicks.



Fig. 3. Tutor made on average values of the articulator.



Fig. 4. Resin adjustments of the tutor during mandibular movements.

a deconditioning of the facial muscles, which had contracted due to the need to adapt to continuous and repeated support on elements that may be badly positioned or no longer intact.

Rearranging the mandibular movement to a physiological movement means obtaining a physiological positioning of the mandible whose condyles will find the right seat in the glenoid cavity and therefore the restoration of the centric relationship, the only stable and repeatable position both physiological and adapted, as in the case of intracapsular damage.

The shapes deriving from the modeling of the brace lead the mandibular movement and determine the area of movement of the mandible, deconditioning the facial muscles to adapt the movement by leaning on poorly positioned or no longer intact elements. By resting the dental elements of the lower arch on the brace positioned on the upper arch, the mandible was thus able to find the right supports on the teeth, to express the physiological movement of the muscles. The first modeling was then improved during the delivery session of the brace, by manipulating the mandible.

The patient wears the brace strictly during the night and progressively more and more hours during the day. The improvements in the joint position and the relaxation of the muscles are consolidated on the brace with subsequent sessions every 15 days (Fig. 5).

At each session a further improvement is induced, which will be perfected in the following session, where the shapes on the brace are changed by adding



Fig. 5. *Final stage: a stable joint position is obtained.*

or removing the resin. The sessions last until a stable joint position is obtained and the patient can and must wear the brace as much as possible within 24 hours (Fig. 6, 7). With the appropriate daily use of our brace for a period of about two months, a new joint position is now more physiological and repeatable.

This new joint position, with its occlusal relationship, is recorded using waxes and a facebow and transferred again to an articulator at average values (Fig. 8) and verified with ultrasonic axiography. The transfer of the new joint situation, free from dysfunctions, pre-contacts and, or dental interference, will be preparatory to the technical realization of a correct dental work program, that will



Fig. 6. *Completed modelling: stable contacts in centric relationship and repeatable movements conducted on the slopes built in resin.*

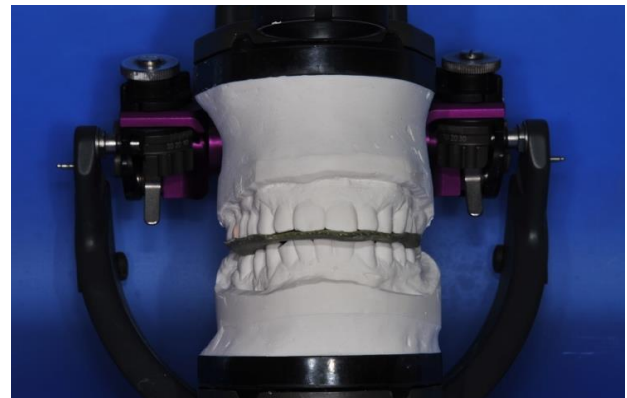


Fig. 7. *Axiographic joint recordings of the new situation, free from dysfunctions, waxes and face bow, that have been transferred to the articulator at average values and verified by ultrasonic axiograph.*



A.



B.

Fig. 8. *A, B): Assembly in the articulator of the new joint position obtained with the pretreatment.*

be stable and lasting. Therefore, this pre-treatment allows an accurate diagnosis, which allows to define the most suitable work program, achievable through a multidisciplinary dental approach.

At the end of the treatment with the brace, the condyles find the right seat in the glenoid cavity and so we obtain the restoration of the centric relationship. This is the only stable and repeatable position both physiological and adapted, as in the case of intracapsular damage. The maximum opening of the mouth is thus obtained (Fig. 8, 9).

With the analysis of this case, we describe the eventuality for which it is necessary to proceed with a rehabilitation through a prosthetic phase, as several elements are involved in wear, fractures or inadequate shapes. The transfer on the articulator will be preparatory to the realization of a diagnostic wax-up and temporary crowns that will be therapeutic. Following a diagnostic wax-up of the dental areas to be modified (Fig. 10),

the conditions are created for the fabrication of the temporary resin crowns (Fig. 11).

Our temporaries suitably modeled on an average value articulator are positioned in a single session on the patient, upper and lower arch together (Fig. 12), with the intention of transferring the same position packaged on the articulator, immediately allowing the patient's stomatognathic system to further improvement of the atm functions, assuming the same function of the brace used at the end of the modeling. Thanks to the placement of the provisionals, the patient will be able to take advantage of that modeling during all 24 hours of the day. The use of the provisionals of both arches, whose occlusal relationships are verified and preformed, allows the stomatognathic system to stabilize the improvement of the TMJ functions. The harmonization between the shapes and functions of the dental elements supports the correct synergistic movement of the muscles and of the atm, suitably

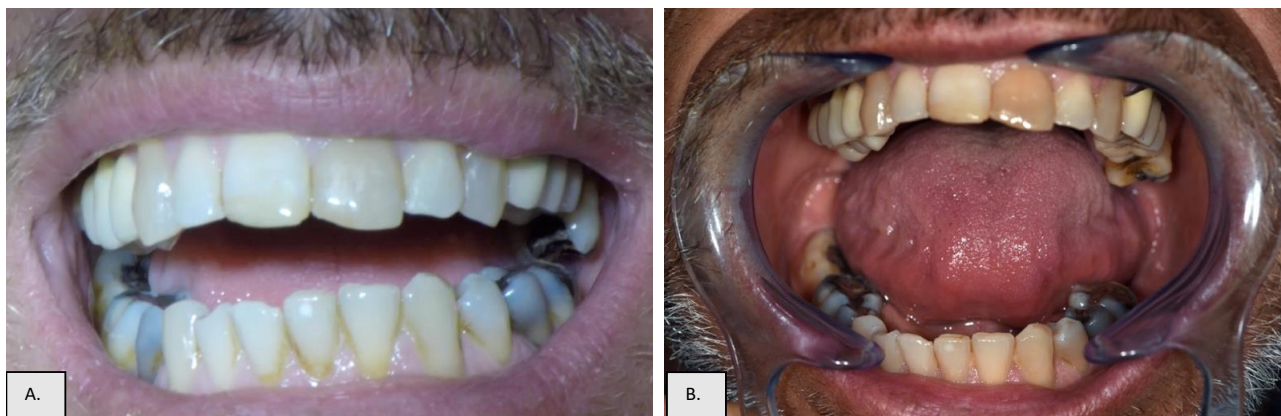


Fig. 9. A, B): Assembly in the articulator of the new joint position obtained with the pretreatment.

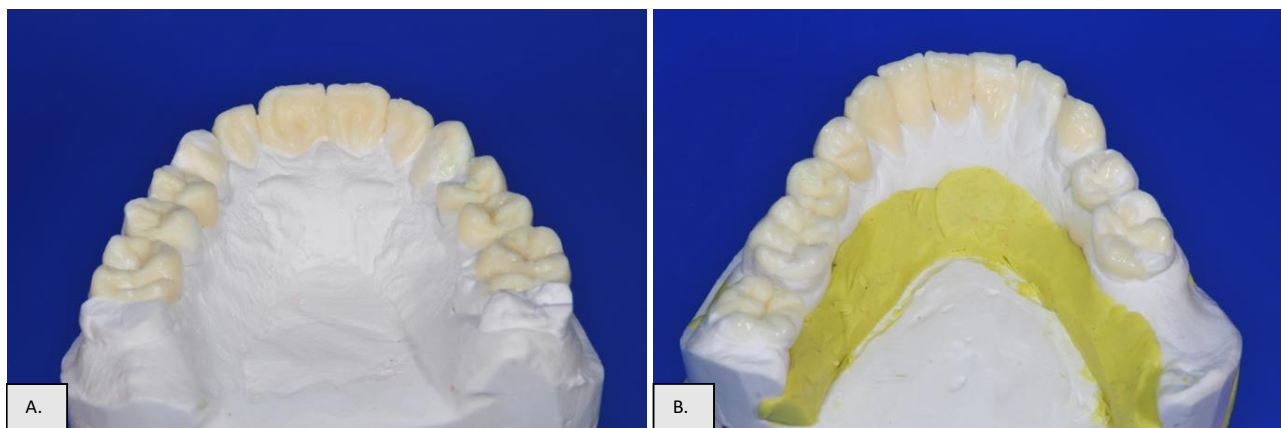


Fig. 10. A, B): Diagnostic gnathological wax up.

supported by these new tooth shapes. It will be precisely the harmonization between the shapes and functions of the dental elements to support the correct synergistic movement of the muscles and of the TMJ, appropriately supported by these new tooth shapes (Fig. 13).

The protrusive and lateral movements are linear and carried out without difficulty in a repeatable way. The routes show the linearity and the repeatability



Fig. 11. *Temporary crowns.*



Fig. 12. *Temporary crowns after 15 days.*



of the movement, conducted by the muscles (Fig. 14). Stability and reproducibility of movements will be guaranteed during the performance of all daily functions, such as phonation, swallowing and masticatory cycle. By means of appropriate sessions of selective grinding and suitable reconstructions in resin, of ridges and slopes with different inclinations, the shapes and positions of the various temporary elements are perfected.

These modeling allow the tripod meeting between the rear antagonist elements and the right disclusion during eccentric movements.

Through these careful interventions on the dental elements, it is possible to follow and to promote the improvement of the movement and the occlusal position. That is to say that in every point of space the patient dislocates his mandible will now find the supports on the dental elements, such as to support the muscular load.

All that in the ambition, as far as clinical and physiological possibilities are concerned, to rehabilitate the system from intra and extra capsular damages that have occurred over time, which are inevitably produced, in the event of incoordination of the muscles-teeth -atm system. Only after having achieved this result, will it be possible to finalize the treatment with the creation of definitive single crowns, using less usable materials, suitable for obtaining stable resolution over time.

RESULTS

There are different types of treatments for diseases



Fig. 13. *A, B): Control and verification of centric occlusion and the regularity and stability of the movements sliding on the teeth.*

related to the temporomandibular joint. There are treatments with aids of release plates, of bite planes, of rigid or soft consistency, mounted on the upper or lower arch, or in any case equipment that modify the occlusal relationships by inducing in a coercive and static way a position of the mandible different from the usual one, but often forced.

There are types of resin equipment built with a randomized shape, which exclude the contact of the arches inducing another occlusal relationship, and therefore a different muscular and articular working relationship. All of these causes an alteration of the state of the stomatognathic system which can give different results but usually does not induce the restoration of the physiological muscular work, and therefore a refocusing action on the position of the meniscus; they are mostly mouthguards, which can induce a momentary relief of the muscle tension pathology or apparently reduce the wear of the teeth only at the time of use (60-62).

Both rigid resin and soft silicone aids of various kinds are used, mostly generated based on the patient's tooth impressions, therefore perfectly fitting, but with absolute unpredictability and unrepeatability of a stable and repeatable occlusion as little is done in terms of a rearrangement of intracapsular physiological conditions.

The first phase of our treatment, manifested using the personalized brace, led to the resolution of joint

and muscular problems thanks to the restoration of the musculoskeletal centric relationship in centric occlusion and the guidance of eccentric movements, when the brace was worn by the patient. In the second phase of the treatment with the positioning of the temporary crowns, the new centric position was confirmed with the stabilization of the posterior contacts and the incisive and canine guidance, definitively ensuring the resolution of the muscular-articular problems.

The treatment performed, therefore, allowed to obtain a coordinated movement of both temporomandibular joints, the resolution of the joint block and of the reciprocal and bilateral click. This led to a marked improvement in mouth opening and occlusal stability in centric and eccentric movements. The improvement of the physiology of the movement of the chewing muscles has caused by adaptation, a clear improvement of all the other muscles that participate in the posture of the whole organism, the remission and disappearance of symptoms such as headaches, muscle pains, joint clicks, dizziness, tinnitus and buzzing present. For a long time and complained by the patient daily.

DISCUSSION

It is evidently noted how chewing, phonation, swallowing has improved, how stable and

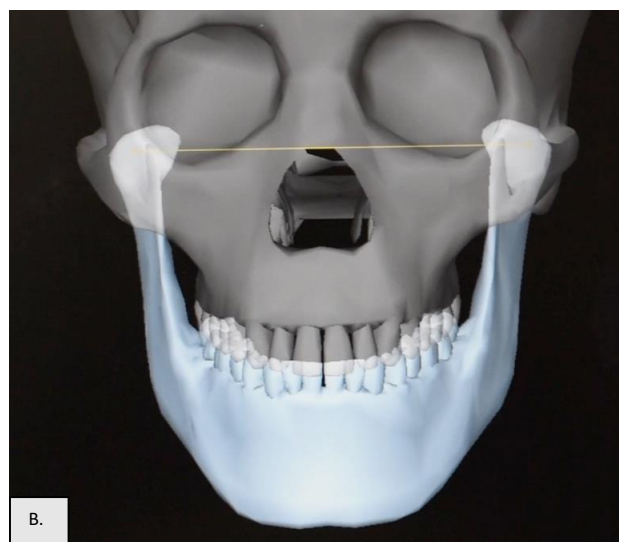
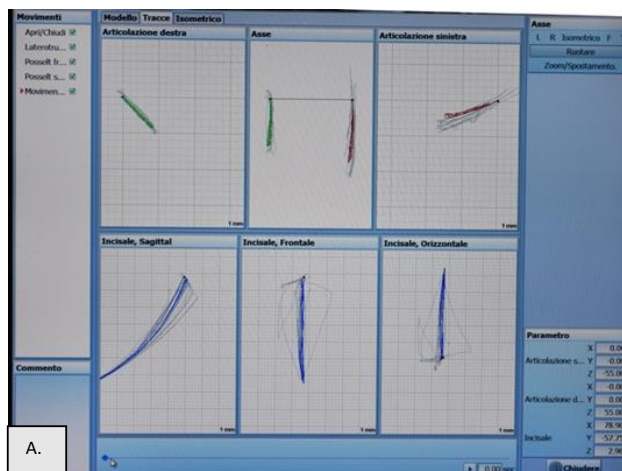


Fig. 14. A, B): Control and verification axiography.

homogeneous the periodontium is with excellent appearance, tone and trophism, already from the temporary state obtained with the temporary crowns. The patient confirmed the sensation of a clear improvement in the chewing capacity and therefore of the subsequent digestion, all obviously guaranteed by the stability and therefore by the renewed muscular capacity and by the repeatability of the movement that guarantees the ideal performance to the stomatognathic system.

CONCLUSIONS

The presentation of this case confirms how the concepts dictated by classical gnathology, implemented by the regularization of the extension of the movements, are still necessary and sufficient for the stable and lasting resolution of dysfunctional pathologies.

The gnathological pre-treatment is a necessary and sufficient action to allow the most accurate and predictable diagnosis, to ensure the stability over time of our dental care. The obvious need to carry out this gnathological pre-treatment highlights, in the light of our clinical experience, a concept that is fundamental for us: the displacement of the TMJ is to be considered a pathology as well as malocclusion.

Gnathology is movement: little can be drawn from static images, even if the same images presented, however static, are already demonstration of a recovery of periodontal health, which together with the restoration of the functional and aesthetic shape of the dental elements, are evidence of a physiologically functioning system.

Conflicts of interest

The authors declare that there are no conflicts of interest

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