Chapter 4-Treatments considering the occlusal form

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A case where occlusal correction was also conducted with implantation

The advantage of implant prosthetics is that it does not affect the teeth positioned adjacent to the missing tooth. With good prognosis of the neighboring teeth, life of the remaining teeth has been shown to be prolonged by implant treatment[1]. Meanwhile, the recovery of the masticatory functions by the implant prosthetics can subsequently subject mechanical pressure to the implant body themselves[2]. As the implant body must bear the large masticatory force, the substantial pressure can result in the fracturing, screw loosening and its fracture, and the acceleration of the bone resorption[3]. For a long-term prognosis of implant treatment, it can be said that the extensive understanding of the maxillofacial physiology and of the functional occlusion system[4] (Fig. 1) that forms the basis of dental articulation are essential.

There are a number of factors that are known to affect the prognosis of implant treatments such as: edentulous arch, bone quantity/ quality, infection, and load bearing. The most frequently arising complication is the peri-implantitis, followed by the load exertion from the dental articulation[5], which in turn affects both the superstructures and the body.

In the recent years with the ease in the bonding of the implant with the bone, less weighting has been placed on matters such as the occlusal analysis and the means to bestow an occlusion. However, for a good long-term prognosis, occlusions after the implantation must not be taken lightly.

Patient: 34 year-old female
Main complaint: Does not in which region of the mouth she can chew with.
Present disease history: Strains on the back of her neck, stiff shoulders, physical body strain and dry

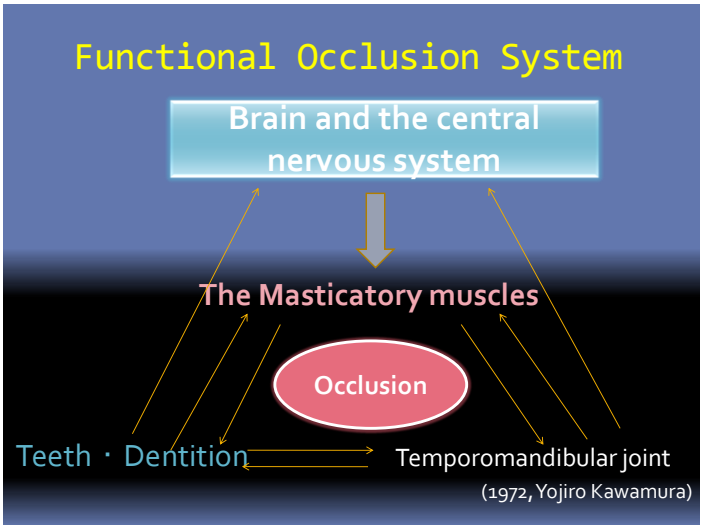

Fig. 1 Occlusion is the interaction between the teeth/ dental arch, masticatory muscles, and the temporomandibular joint components that receive nervous supplies from the central nervous system (CNS) and the brain and are controlled by these. The failure of any one of these components can subsequently affect other factors, resulting in dysfunctional occlusion.

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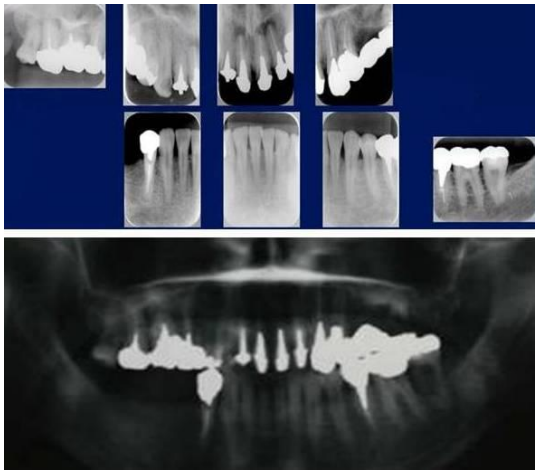

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Fig. 2 Image of the oral cavity at the first clinical evaluation

Fig. 3 Dental and panoramic radiograph at the first examination

1. Analysis of occlusion with CMS

For an implant prosthetic treatment, each components of the functional occlusion system are required to be evaluated to achieving a state in which a sufficient amount of pressure is exerted. Out of the functional occlusion system, occlusion components were examined using computerized mandibular scanning (CMS), K7 Evaluation system[6].

1) Rapid movement of opening and closing of the mouth

Fig. 4 features patient's velocity graph (Velocity) recorded while undergoing maximum mouth opening movements at the normal and at rapid rates, and the movement of the frontal plane (right) that was recorded simultaneously. Along with the opening and closing of the mouth motor pathway, a slight fault can be observed. Regarding the motor pathway during rapid opening and closing of the mouth, since the graph is showing a smooth lissajous curve that is indicative of a coordinated action of the masseter muscle, it appears that the articular disc dislocation has not occurred. Nevertheless, the recordings of the motor pathway of the right frontal plane with the jaw opening and closing displays a disorderly pattern of the centric point of the curve (indicated with red arrows). This is reflective of the patient's main complaint of not knowing with which part of the mouth to chew.

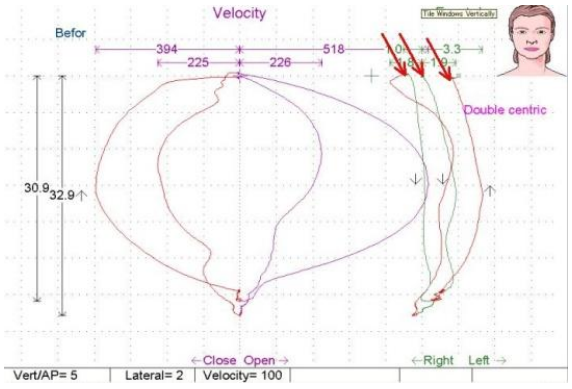


Fig. 4 – The occlusal position is highly unstable during the recording of opening and closing mouth exercise.

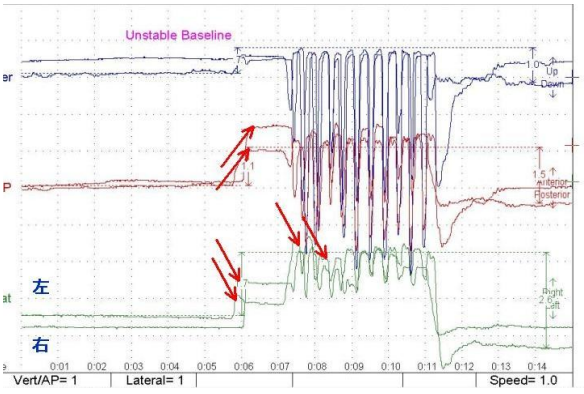


Fig. 5 – A left shift in the posterior occlusal position can be observed in the transfer from mandibular rest position to the occlusal position.

2) Biting from the mandible rest position to the centric occlusion

Fig. 5 shows the kinesiograph recorded while tapping twice at the centric occlusion after shifting from the mandible rest position. The three graphs show the up-down movements on the top, the front-back movement in the middle and left-right movement at the bottom. If there is no displacement of the mandible in relation to the cranium, the free-way space from the position of the muscles are usually around 1.0 mm (±0.5 mm) that shows a ratio of vertical and longitudinal movements to be from 1:1 to 3:1, should not show horizontal displacement.

In this patient, in the shift from the mandible rest position to the occlusal position, the longitudinal movement was found to be more significant than the vertical movement that had a relatively small free-way space, with a particularly unstable centric. With regard to the horizontal movement, there is a cuspal interference on the left undergoing unsteady tapping movement. These recordings suggested that the mandibular position was displaced in both longitudinal and horizontal axis, relative to the skull.

2. Temporomandibular joint examination

At the medical examination conducted ten years ago, an arthrosound was presented. However as there were no pain symptoms, it was left untreated. From this, the disc displacement was suspected. From palpation, a clicking was heard in the right temporomandibular joint during the mouth opening and closing therefore a MRI scan was conducted for further examination.

Fig 6, top right image shows a non-restorative articular disc anterior dislocation, bottom left image shows a restorative articular disc anterior dislocation. Taking into consideration, the absence of subjective symptoms, the age, and the degree of deformation, it was decided that the correction of the articular joint was not practical, and with consent from the patient, the mandibular position (muscular contact position) that was best for the functional occlusion in this state was attempted to be achieved.

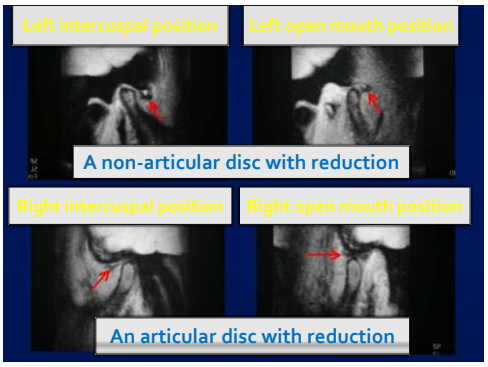
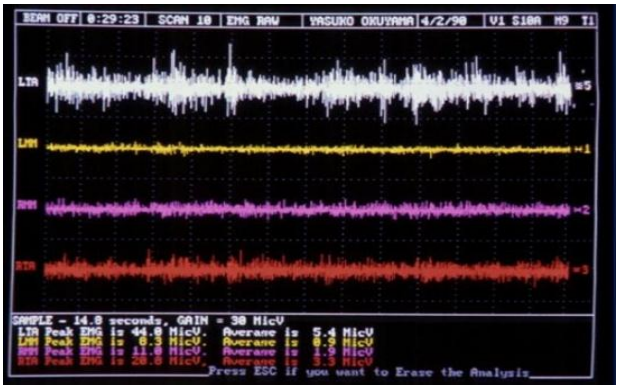


Fig. 6 – The MRI scan of the temporomandibular joint region shows the transition and modification of the articular disc.

3. Masseter muscle examination

Fig. 7 is the electrocardiogram of the left and right masseter muscles and the anterior belly of the temporal muscle at the mandible rest position. The presence of abnormal electrical discharge of the left temporal muscle can be observed indicating the shift in the mandibular position. Fig. 8 features the recording after the patient had undergone a treatment of transcutaneous electrical nerve stimulation (TENS) for a period of 40 minutes muscle relaxation, and shows the muscle tone to have improved [7].



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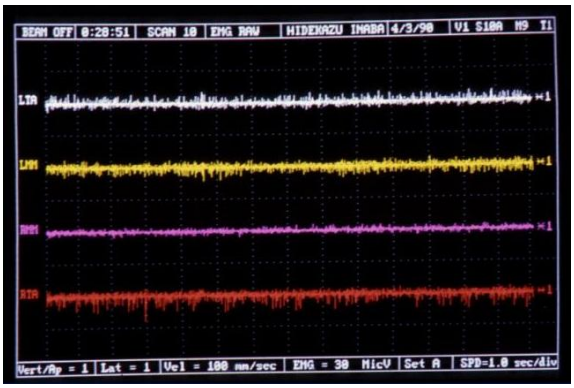

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Fig. 7 – Abnormal electrical discharge of the left temporal muscle

Fig. 8 – Recording of the state after undergoing TENS treatment where the tension in the muscles to show a vast improvement.

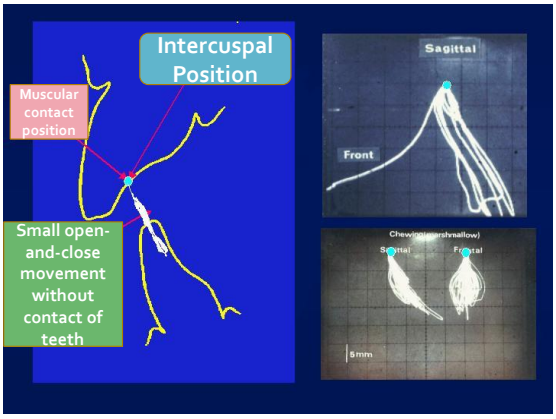
Examination and treatment plan

The analysis of above results confirmed the symptom to have arisen from the shift in the mandibular position relative to the skull, the instability in occlusion, and sense of discomfort in the craniocervical region. The most important consideration that has to be paid in conducting implant treatment is to prevent exertion of excessive lateral force and the occlusal rotary moment on the implant at the time of chewing. The shift in the mandible position in relation to the skull can manifest as shown in Fig. 10, such that the lateral force is exerted on the implant with chewing. Where there is no shift in the position of the mandible relative to the skull, there are no excessive pressure exerted on the implant body, as shown in Fig.9 [8].

The planned treatment is shown below:

a) Extraction of No. 2 tooth
b) Endodontic care of the anterior maxilla teeth as well as No. 5 and 21 teeth
c) Correction of the mandibular position (muscular contact position[9]) with removable orthosis.
d) Refabrication of crown for: No. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 21, 30, 31.
e) Placement of unilateral distal extension bar removable partial denture (RPD) with attachment
f) Perioperative examination of the occlusion with K7 Diagnostic system (for confirmation of the correction of occlusal position and re-evaluation of functional occlusion).
g) Implant treatment for No. 19 and 20.

Having completed the endodontic treatment, carefully adjust the removable orthosis, for which the occlusal impression was taken at the muscular contact position, to ensure that the occlusion can be achieved at the muscular contact position (Fig.11).



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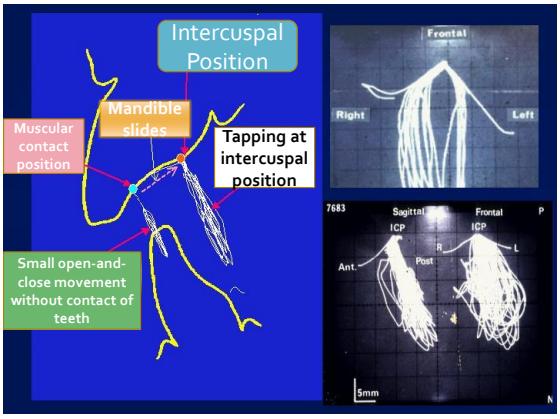

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Fig. 9 – With the absence of any shift in the mandibular position relative to the skull, implant is not subjected to excess lateral pressure.

Fig.10 – If there is a shift in the mandibular position relative to the skull, the implant body becomes subjected to excessive lateral pressure, and rotary masticatory moments with chewing, and subsequently damaging the bone structures surrounding the implant body.

Fig. 11 – Left showing the occlusal impression taking; and on the right, shows the removable orthosis that has been fabricated at the muscular contact position.

Perioperative examination of the occlusion (for confirmation of the correction of occlusal position and re-evaluation of functional occlusion)

The orthosis was adjusted till occlusion was achieved with the mandible positioned at the muscular contact position, and to confirm that the shift in the mandibular position had been corrected in relation with the skull.

Fig. 12 is a record of the mouth opening and closing exercise after the removable orthosis was adjusted to the muscular contact position. It shows the recovery of the shift in the mandibular position in relation to the skull, a motor pathway similar to that of a healthy individual.

Since the shift in the mandibular position was able to be corrected, even though there was still a notch, a smooth lissajous curve in the velocity graph was recorded as shown in Fig. 13, thus confirming a stabilized occlusion to have been set at the muscular contact position.

Fig. 14 shows the recording with the placement of the crown bridge, or unilateral distal extension bar RPD. The ratio of the lateral and longitudinal movements were shown to have improved close to normal, but possibly owing to the fact that the superstructure had only recently been placed, the longitudinal movement was shown to be rather unstable and the muscular contact position to have been displaced to the left side by approximately 0.2 mm. The patient's complaints of the strain at the back of the neck, stiff shoulders, physical strain, and dry eyes were all solved.

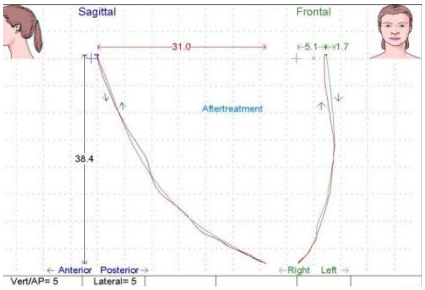


Fig. 12 – The maximal open-close pathway after treating the occlusion has been corrected to the pathway of a normal individual.

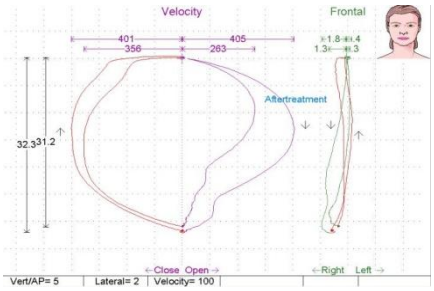


Fig. 13 – The velocity graph of the rapid opening and closing of the mouth exercise pathway shows a smooth lissajous curve, indicating that the position of the mandible had been restored at the muscular contact position.

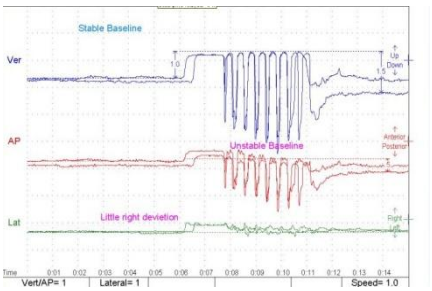


Fig. 14 – The record of the transition from the mandibular rest position to the occlusion position after the occlusion treatment have shown the occlusion to have been corrected to the norm.

Examining the temporomandibular joint

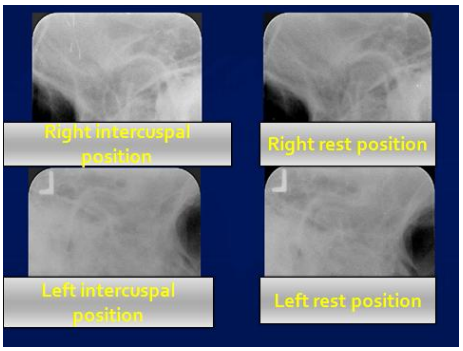
Fig. 15 shows the TMJ radiograph taken with standardized technique, the individualized anatomic X-ray aligner "condyray", after the occlusal correction with orthosis.

Although the left articular disc is shown to have been dislocated, the mandibular condyles on both sides are positioned at the centre of the temporomandibular fossa in the occlusal position as well as in the rest position. The articular joint spaces are also evenly distributed longitudinally.

The left two images of Fig. 16 features the electrical discharge of the anterior bellies of the temporal muscles and the masseter muscles on the left and right, recorded at the time of strong masticatory force application with the natural teeth without any mediators. The images on the right shows the recording with the application of strong masticatory force in the presence of roll of cotton placed in between the teeth. The amount of electrical discharge and the ratio both indicate its recovery to the norm. The results confirmed the mandibular position to have been corrected to the position of the muscles, and that the masseter muscle group to be functioning in a coordinated manner.

From these findings it was concluded that the mandibular position in relation to the skull had been corrected, and that unwarranted occlusal pressure would not be exerted onto the implant body installed.

The implant prostodontic treatment was conducted with the objective of long-term functional maintenance. Fig. 17 and 18 show images with the placement of implant prosthesis, placed after the correction of functional occlusion system. Functional recovery was able to be achieved. The width of the occlusal plane of the implant in the molar region was constructed to be the same as that of the premolar region. The occlusal conditions are checked every three months in the regular follow-up of the oral hygiene conditions.

15 

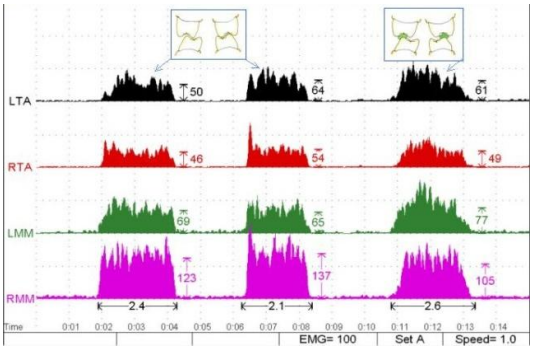
16 

Image-15 – The TMJ radiogram taken by a standardized technique, the individualized anatomic X-ray aligner "condyray", after the occlusal correction with orthosis.

Image-16 – The examination of the dislocation of the mandibular position relative to the skull shows the absence of the mandibular dispositioning, and the co-ordinated action of the masseter muscle group can be observed.

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Fig.17 - The image after the placement of superstructure.

Fig.18 – The image at the time of follow-up, five years after the implant installation.