

# Consideration of the Mandibular Position in Implant Prosthetics

*Tsunehiko Matsushima, DDS, PhD, FICCMO*

## **Abstract:**

Objective evaluation of the mandibular position is essential for planning implant prosthetics. Implant prosthetic treatment has a risk of post-operative mandibular dysfunction such as the mandibular displacement and associated TMD due to intrinsic implant features, unless the pre-operative mandibular position that is not in harmony with the functional occlusal system is corrected. Therefore pre-operative evaluation of the mandibular displacement is the most important step for occlusal reconstruction.

This report presents the cases in which evaluation of the mandibular position and occlusal reconstruction were performed based on the neuromuscular concept, and good outcome was obtained with use of Golden Vertical as a parameter of occlusal vertical dimension in addition to use of K7 for evaluation of jaw movements and EMG.

Furthermore, methods of occlusal reconstruction with implant prosthetics are classified according to

evaluation of the mandibular position. Occlusal reconstruction at the myocentric position with stable condylar head is considered to be an important factor for rehabilitation of the stomatognathic function and long term functional stability of dental occlusion.

## **I. Introduction**

In all cases of implant therapy, a dentist should aim at minimum invasive approach and shortening of treatment period. It is needless to say, however, that safety and predictability must be assured. If a dentist hastens too much to complete a case in a short period of time and does not make adequate pre-operative evaluation, the treatment goal, that is, rehabilitation of the stomatognathic function would not be achieved, resulting in post-operative malocclusion and TMD,<sup>1</sup> and symptoms may be worsened in some cases.

There have been some reports on chronological change of the mandibular position and high

incidence of TMD after treatment of implant prosthetics,<sup>2</sup> so that careful follow up and appropriate handling are needed after treatment of implant prosthetics. The author performs occlusal reconstruction at the myocentric position<sup>4</sup> that is in good harmony with masticatory muscles, TMJ and dentition that consist of the functional occlusal system.<sup>3</sup> In clinical practice, K7 evaluation system (hereinafter called K7) is used for implant prosthetics to evaluate the mandibular position.<sup>5</sup>

In this report the author describes significance of the myocentric position in rehabilitation of the stomatognathic system with implant prosthetics and methods of occlusal reconstruction based on evaluation of the mandibular position.

## II. Significance of the myocentric position in implant prosthetics

Significance of the myocentric position is considered through cases of implant prosthetics. This is a case of a 57-year old man with passing defect for whom implant prosthetics of hybrid ceramic was provided in the edentulous area at the existing mandibular position without pre-operative evaluation of the mandibular position (*Figure 1*).

Half a year after treatment, the mandibular position was examined with Scan 5,<sup>6</sup> which revealed the right posterior displacement (*Figure 2*). Particularly 1mm displacement to the right was noted, for which he was put in careful observation

with no procedure, because the patient remained asymptomatic at that time.

Two-and-a-half years after treatment, facets on occlusal surfaces of posterior hybrid ceramics became notable, and destruction of tooth substance progressed gradually due to attrition. Five years after treatment, change of the whole dentition started to be observed including diastema and loosening of inter-proximal contacts as well as frequent dislodgement of crowns.

At 6 years and 3 months after treatment, the patient came to the clinic with chief complaint of the crown fracture of the right lower no. 5 (*Figure 3*). The extent of diastema was increased, and attrition of posterior occlusal surfaces was further progressed. The patient also complained of chewing difficulty. With the patient's consent, therefore, the mandibular position was evaluated with K7 to fabricate a new prosthesis with improvement of occlusion. In Scan 11 the action potential of the right and left masseters did not increase at the existing centric occlusion (hereinafter called CO) during maximum clenching test, and the EMG level of the right and left temporalis was also very low. On the other hand, maximum clenching with cotton rolls between bilateral posterior occlusal surfaces showed adequate action potential of all muscles including the right and left masseters and temporalis (*Figure 4*). This indicates that the posterior occlusal contacts are not sufficient at



Figure 1.

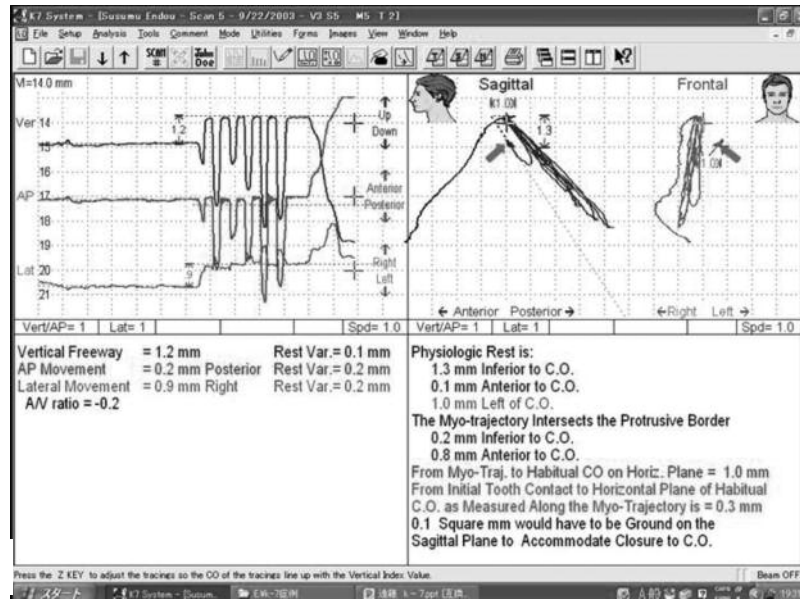


Figure 2.



Figure 3.

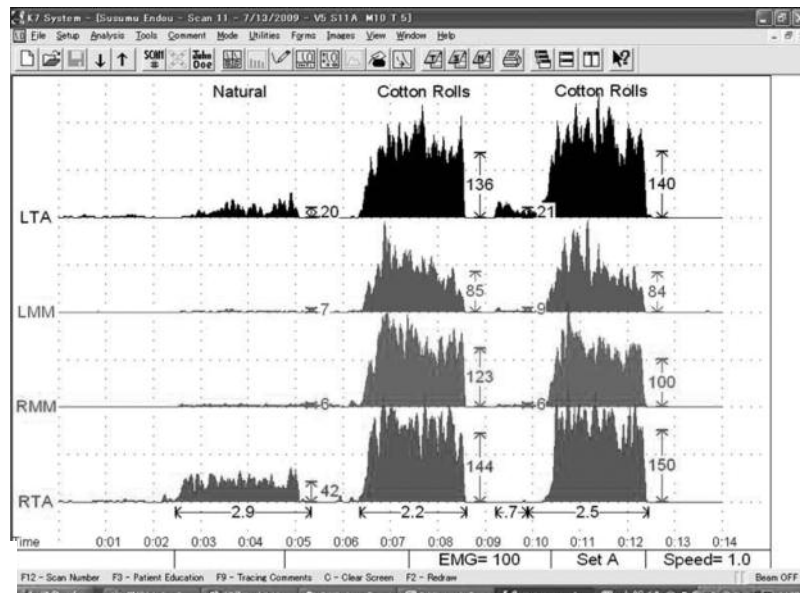


Figure 4.

the CO, which explains the patient's symptom of chewing difficulty. The antero-posterior mandibular displacement was not observed in Scan 5, but the 1.1mm displacement to the right remained. (Figure 5)

The reason for the right displacement of the mandible seems to be associated with little progression of attrition due to metal on the lingual surface of the upper left cuspid as well as its good supporting bone, resulting in little tooth movement. Thus the lateral interference could not be removed. With elimination of the occlusal interference, the mandible could move in the anterior direction, which, in turn, corrected the anterior-posterior displacement of the mandible. In the natural course of elimination of the occlusal interference, the mandible could move in the anterior direction, which, in turn, corrected the anterior-posterior displacement of the mandible.

Therefore in order to correct the right displacement of the mandible in reference to the upper and lower incisal lines, the mandible was shifted by 1 mm to the left. The frontal view and right and left profiles of the patient with the corrected mandibular position are shown in Figure 6.

Just 1mm lateral shift of the mandible in anterior results in significant displacement of intermaxillary relationship in posteriors.

Resurfacing of the provisional prosthesis was made at this position. Namely, cold cure resin was added on the occlusal surfaces of the provisional restoration in consideration of the occlusal plane in order to fill the gap and correct the mandibular position. The precise myocentric position was confirmed in Scan 5 after resurfacing (Figure 7). After confirmation of adaptation to this myocentric position, the final restoration was fabricated (Figure 8). Since then, about 5 years have passed. No change in the mandibular position has been observed in post-operative evaluation with K7 at the myocentric position (Figure 9).

Chronological change of occlusion for about 6 years from the delivery of the last final restoration to the start of re-fabrication of the restoration was studied on the study models on the articulator. In the frontal view flare-out and diastema which seemed to be caused by labial rotating pressure to upper anteriors have become more notable. (Figure 10) Scan 5 data in comparison to

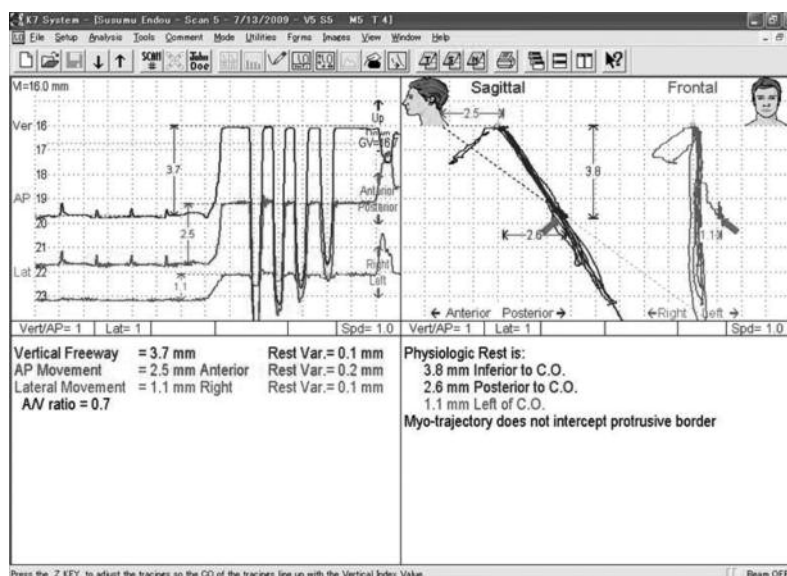


Figure 5.



Figure 6.



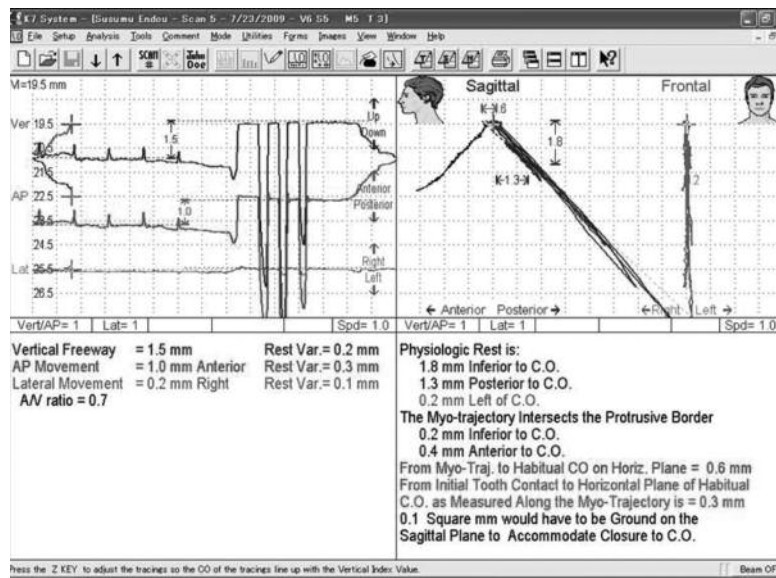


Figure 7.

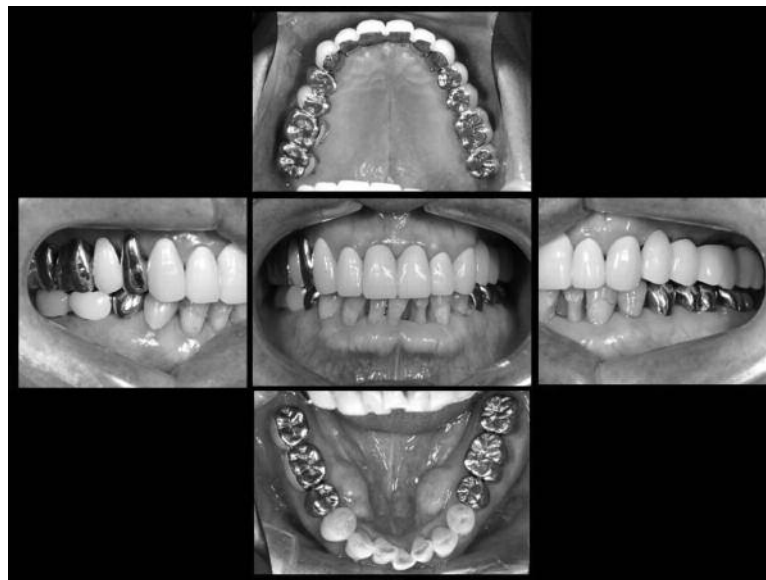


Figure 8.

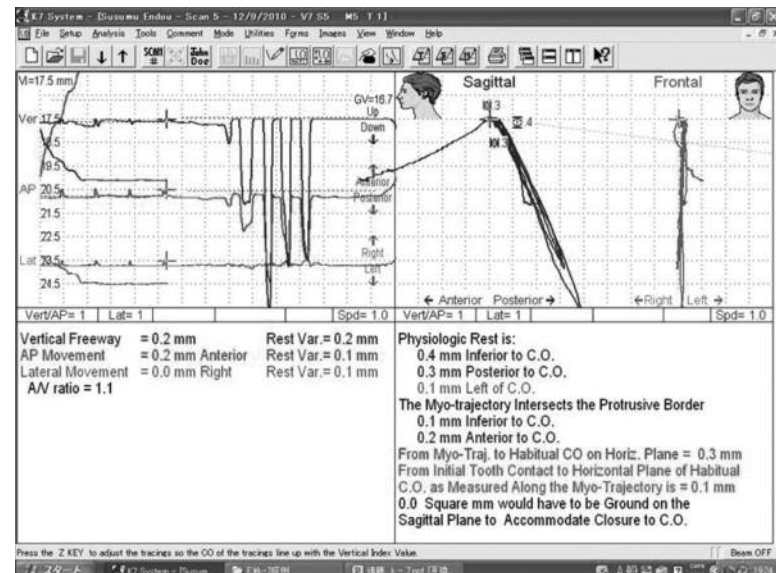


Figure 9.

this change seems to suggest that it is attributable not only to decrease of posterior occlusion but also to mesial movement of the mandible.

Furthermore the positional relationship of distal proximal surfaces of the upper and lower no. 7s in right and left profile view obviously reveal that the mandible has moved mesially. There was tight intercuspation in one tooth to two teeth in the starting time, but due to mesial movement of the mandible and anterior rotation, posterior support has been lost and the lower right no. 5 fell off (*Figure 11, 12*).

In consideration of a series of chronological change, it is concluded that occlusal reconstruction without evaluation of the mandibular position accompanies a risk, which could result in change of the post-operative mandibular position, destruction of occlusion and malocclusion. The long term functional stability cannot be achieved without comprehensive treatment strategy starting with pre-operative accurate diagnosis of the mandibular position and correction to the myocentric position.

### III. Methods of occlusal elevation based on evaluation of the mandibular position

In order to grasp needs and methods of occlusal elevation, objective evaluation of the mandibular

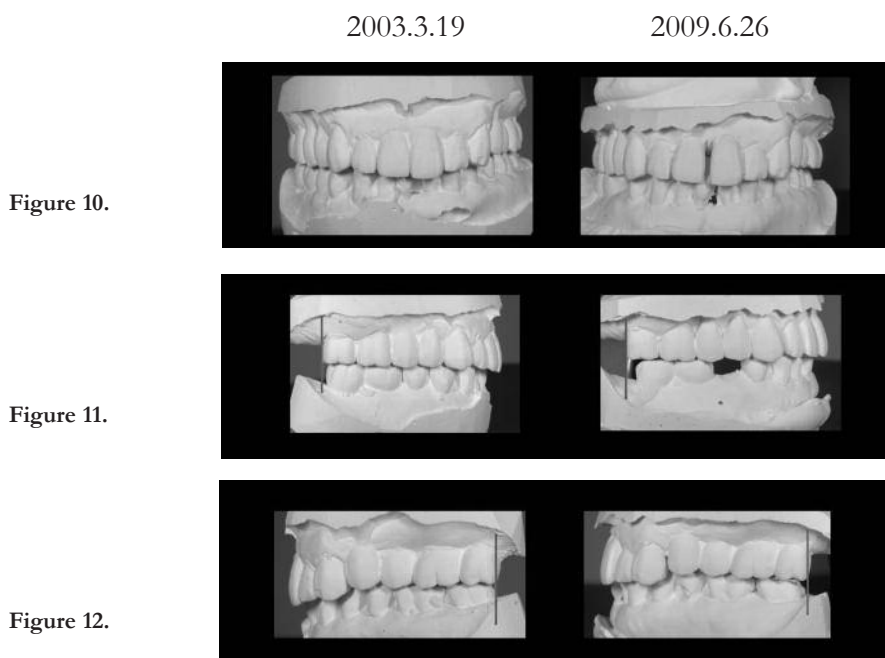
position is indispensable. Implant therapy should be provided at least with prediction of the physiologic and functional mandibular position. Among similar cases of over-closure with insufficient posterior prosthetic space, different approach to occlusal elevation is needed depending upon evaluation of the mandibular position.<sup>7</sup> In case 1 which had the mandibular displacement, occlusal elevation and correction to the myocentric position were performed at the same time. In case 2 which did not have mandibular displacement, occlusal elevation was made while maintaining the myocentric position.

I would like to emphasize significance of pre-operative evaluation of the mandibular position through these 2 cases.

#### Case 1:

The patient had over-closure and requested implants in the lower right edentulous area. There was not enough prosthetic space (*Figure 13*).

Scan 5 revealed the posterior displacement of the mandible. Treatment plan was made to correct the mandibular position and to gain prosthetic space in posteriors at the same time with no anterior restoration. Therefore occlusal registration was performed at the intersection of the physiologic closing trajectory with the incisal guidance path



(shown in red circle) (Figure 14). The lower incisal edge was moved in the antero-inferior direction with occlusal contact on the lingual surface of upper anteriors, while posteriors are disoccluded, resulting in occlusal elevation.

Occlusal reconstruction was made in 4 posterior blocks with no anterior restoration (Figure 15), and the mandibular position was corrected to the myocentric position (Figure 16).

In this way, the prosthetic space could be gained in posteriors with no need for anterior restoration.

### Case 2

The posteriors are in contact with residual roots or gingiva at CO. It is obvious that prosthetic

treatment cannot be provided in this condition, and that occlusal elevation is needed (Figure 17). In Scan 5 no mandibular displacement at the myocentric position was observed at all (Figure 18).

The cuspids had stable occlusion in class 1 relationship. This is the very reason that this case accompanies difficulty. This is by no means a simple case. If acceptable, a dentist prefers to provide prosthetic treatment with the existing mandibular position. In this case, however, occlusal elevation is needed by way of rotating the mandible on the habitual closing trajectory. The substantial amount of elevation in anteriors is needed to gain the minimum necessary prosthetic space in posteriors.

There is Vertical Index<sup>8</sup> (hereinafter called VI) as an objective parameter of occlusal vertical



Figure 13.

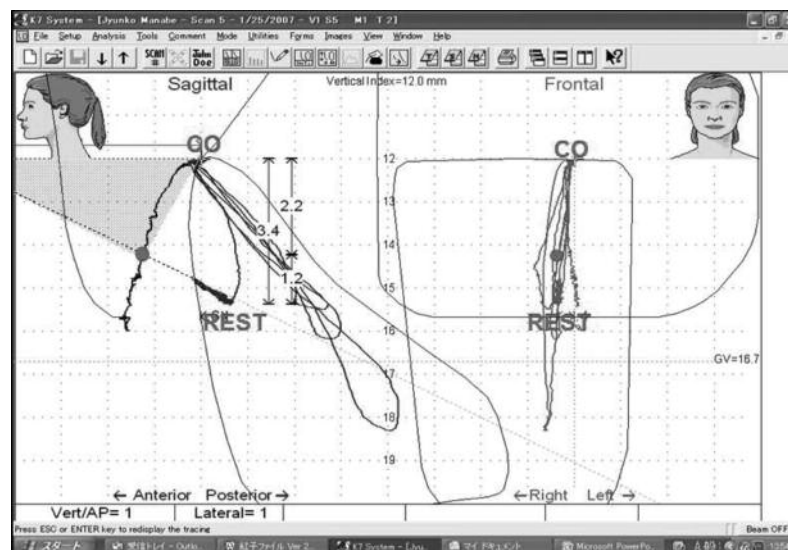


Figure 14.



Figure 15.

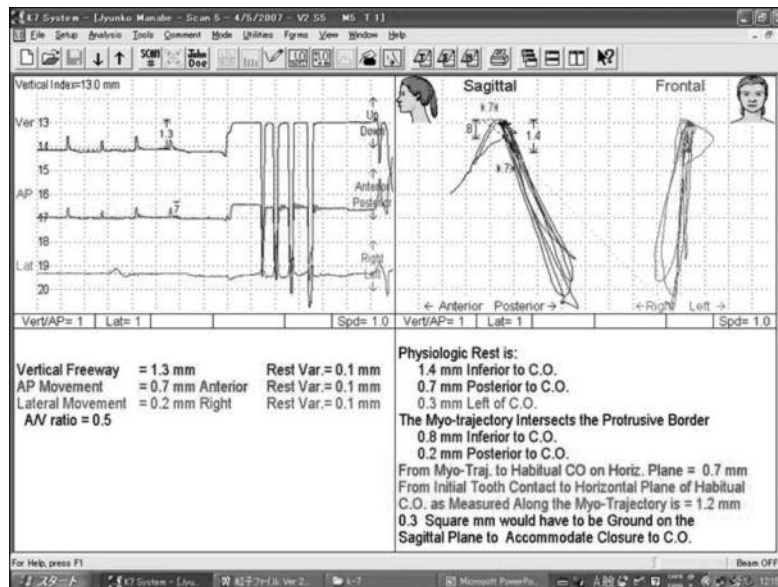


Figure 16.



Figure 17.



dimension. It is vertical distance between CEJs of upper and lower central incisors at the maximum intercuspal position. Golden proportion is applied to this index in order to establish ideal appearance of upper and lower central incisors at the maximum intercuspal position.

The ideal VI, that is, Golden Vertical (hereinafter called GV) is obtained by multiplying 1.618 by ideal length of the upper central incisor based on the golden proportion of 1 to 1.618. The ideal tooth length is obtained by dividing tooth width by the ideal aspect ratio (0.775) (Figure 19).

Then the gain of posterior clearance was examined on the model, when occlusal elevation was made in reference to GV (Table 1). It is not

just elevation of the incisal pin by 3 mm from the CO position. Occlusal registration was performed with a target point being the intersection of the habitual closing trajectory with GV (indicated by red circle), and the upper and lower study models were mounted to an articulator (Figure 20). Ideally I wanted to have a little more posterior clearance, but decided to see how the patient would adapt to this amount of occlusal elevation by placing an orthosis with this GV dimension (Figure 21). The patient reported that she could adapt, with no particular problem, to about 3 mm occlusal elevation in anteriors. Thus the problem of inadequate prosthetic space was solved and I proceeded with implant placement. (Figure 22)

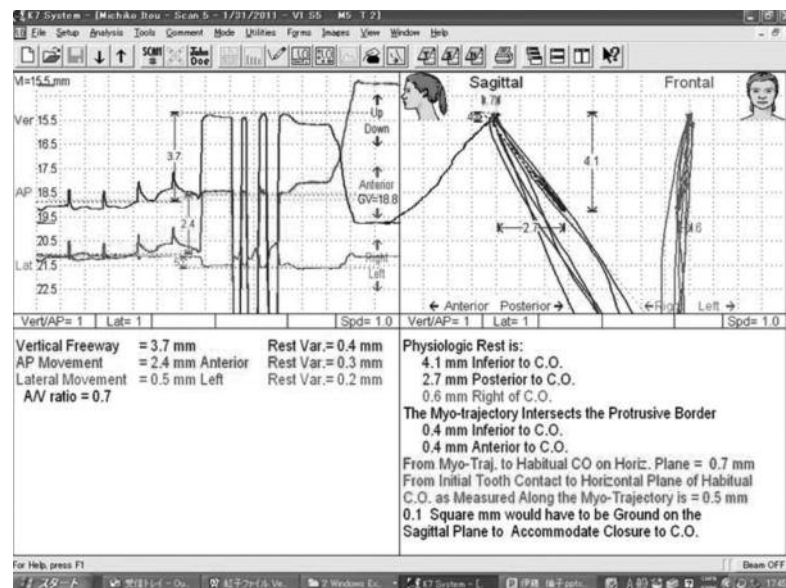


Figure 18.

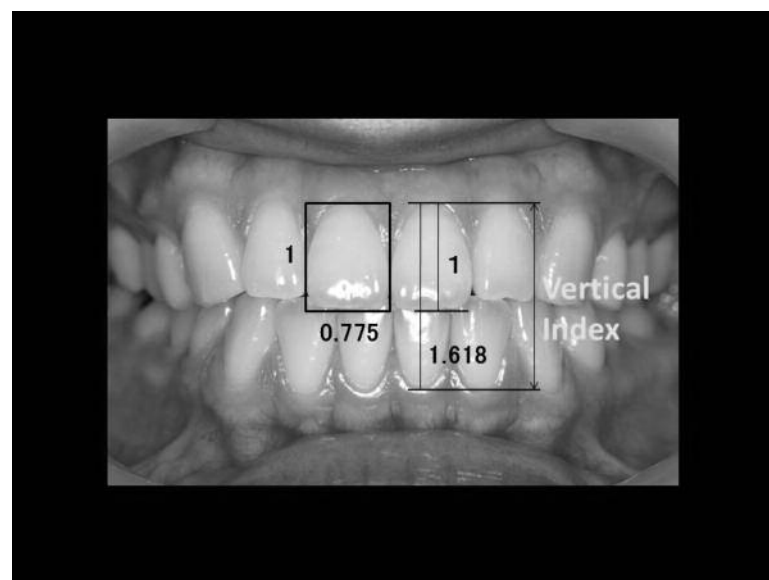


Figure 19.

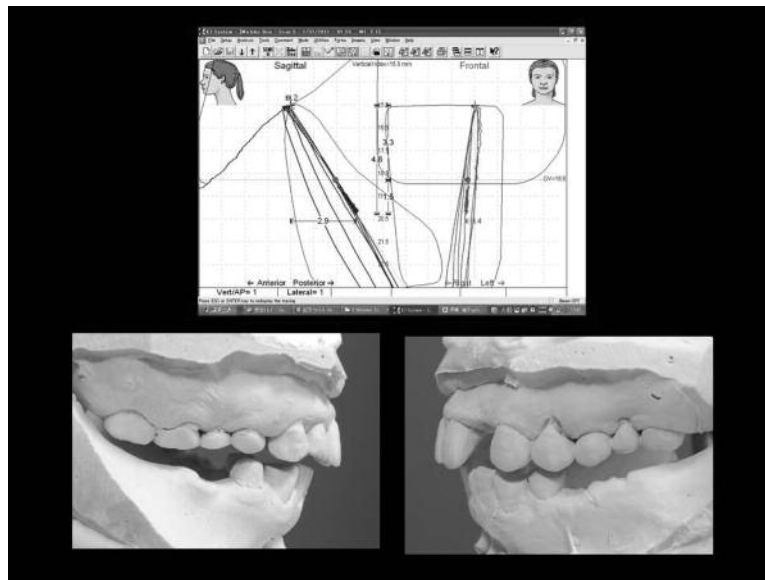


Figure 20.

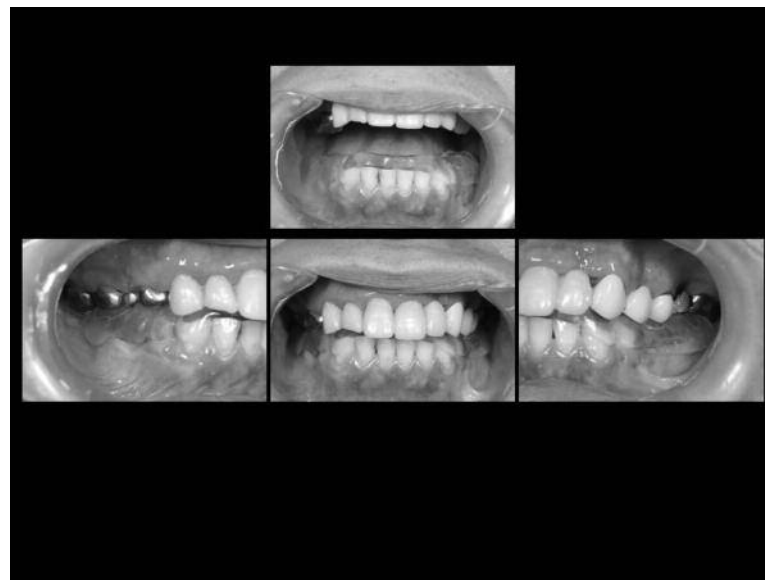


Figure 21.

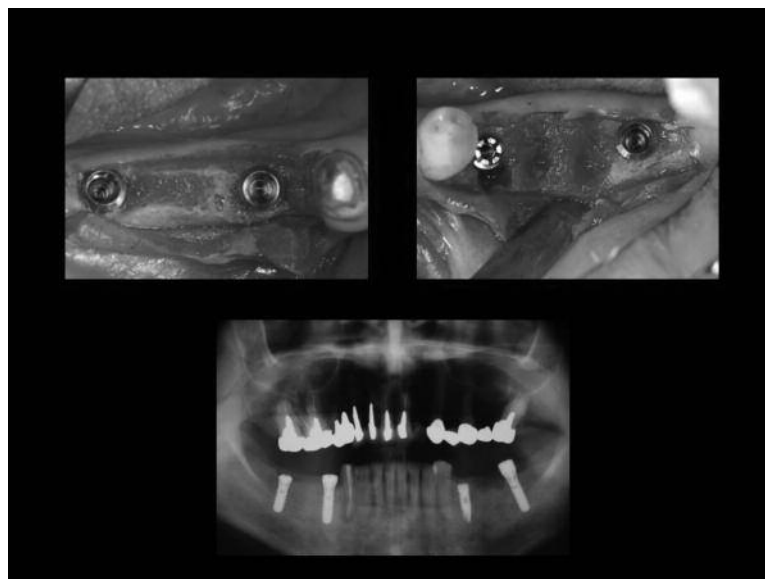


Figure 22.

Upon delivery of the full mouth provisional restoration, functional esthetic evaluation<sup>9</sup> was made (*Figure 23*). There was no problem in the overall construct, so that detail procedure was performed. The final restoration was delivered after MTM and whitening of lower anteriors (*Figure 24*). The post-operative follow up shows very good condition.

#### IV. Occlusal reconstruction with implant prosthetics based on evaluation of the mandibular position

I presented the methods of occlusal elevation for over-closure cases with and without the mandibular displacement. In application of this

concept, methods of occlusal reconstruction with implant prosthetics are classified according to evaluation of the mandibular position. Conditions before and after occlusal reconstruction with corresponding Scan 5 recordings are shown for each classification.

##### 1a:

Scan 5 shows no mandibular displacement at the myocentric position and adequate occlusal vertical dimension. It is only implant prosthetics in edentulous area that is needed. Care must be taken to maintain the existing mandibular position, and not to lose the myocentric position, when implant prosthetics is fabricated (*Figure 25*).



Figure 23.



Figure 24.

**1b:**

The mandibular position is not displaced, but there is not adequate intermaxillary clearance in posteriors, so that occlusal elevation is needed. The occlusion is elevated by rotating the mandible on the arc of the habitual closing trajectory, and full mouth prosthetic treatment including anteriors or comprehensive rehabilitation including orthodontic and/or surgical treatment should be taken into consideration. In such a case GV serves as a parameter to determine the amount of occlusal elevation, for which multi-factorial evaluation should be made including the lower facial height and facial profile 10 (*Figure 26*).

**2a:**

This is often seen in Class 2 cases with over-closure, in which the mandible is retruded with inadequate prosthetic space in posteriors. When anterior restoration is not needed, however, the occlusal elevation can be made by translatory, parallel movement of the mandible in the antero-inferior direction on the incisal guidance path (*Figure 27*).

**2b:**

In case the mandibular position is displaced, and full mouth rehabilitation including anteriors is indicated, esthetic restoration in anteriors can be made with use of GV as a parameter of occlusal vertical dimension 11 (*Figure 28*).

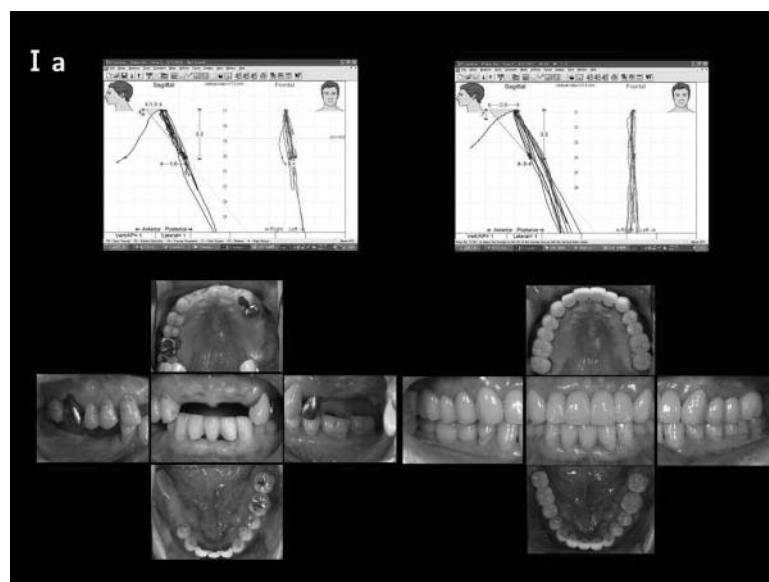


Figure 25.

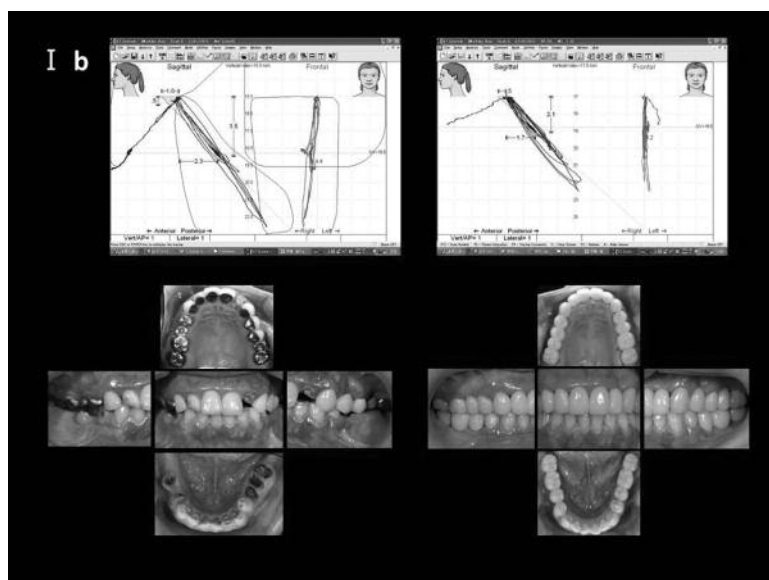


Figure 26.



3:

In case of non-vertical stop occlusion or totally edentulous cases, teeth cannot be used as a parameter, so that use of provisional dentures for minimum restoration of function and diagnosis of the mandibular position is necessary as much as possible within the limit in which denture displacement or mobility does not result. For this purpose use of natural teeth to be extracted and provisional implant 12 or application of stable dentures or denture bases on the implant cuff should be considered (Figure 29, a.b.).

## V. Discussion

When occlusal reconstruction with implant prosthetics is considered, it is risky to provide it without objective evaluation of the mandibular position and theoretical background of the method of occlusal reconstruction. While implant therapy is very useful in occlusal reconstruction, its misuse could be a contributing factor to destroy the stomatognathic function. For this reason pre-operative diagnosis of the mandibular position, with the correct head position, in reference to the physiologic rest position of the mandible is indispensable. Only when the 3-dimensional position of the mandible in relation

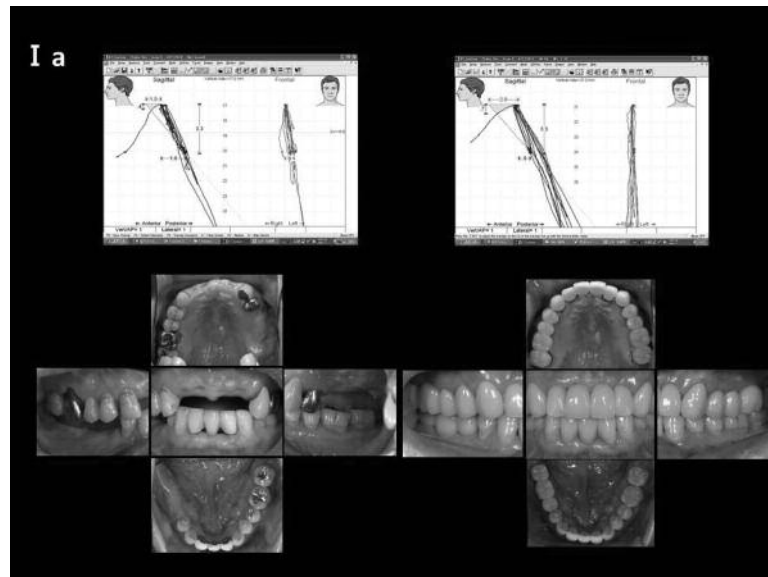


Figure 27.

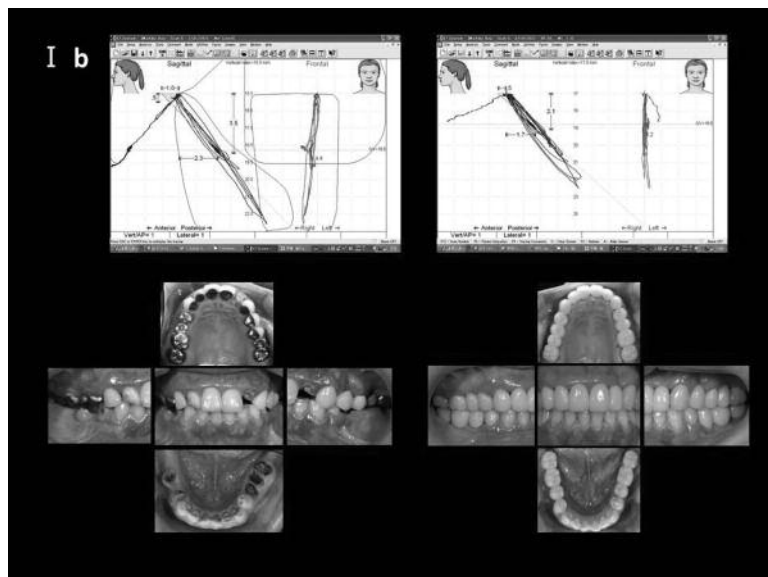


Figure 28.

to the maxilla is established in good harmony of 3 factors of the functional stomatognathic system, ie, dentition, the temporomandibular joint, and masticatory muscles, a concrete plan of such steps as implant site, method of implant placement, bone augmentation, orthodontic treatment, or surgery can be made as well as the extent of intervention indicated. At the same time, we should always keep in mind how to achieve maximum effect of treatment with minimum necessary intervention in a comprehensive perspective.

Comparing with a conventional, trials-and-errors approach to occlusal reconstruction, use of the physiologic rest position of the mandible as an objective parameter for grasping the physiologically appropriate 3 dimensional relationship of upper and lower dentitions enables us to make a treatment plan more readily and shorten a period of treatment.

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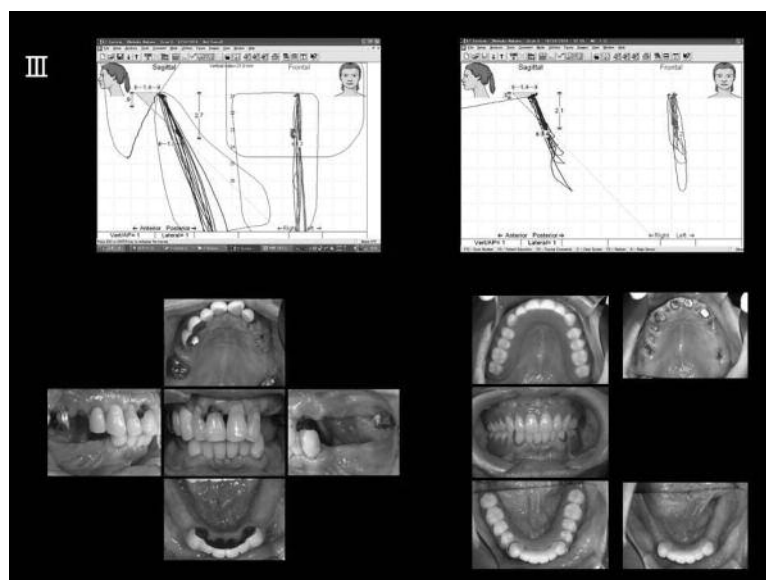


Figure 29.