

## THE SUCTION MECHANISM OF THE LOWER COMPLETE DENTURE

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This report is written by Dr.Jiro Abe in Japan.

The purpose of the conventional denture is to enlarge the denture bearing zone based on the landmarks of the muscle attachments. As a result it makes the denture stabilized and retentive.

On the other hand, the purpose of the suction denture in the mandible is to seal the entire border of the denture with the oral soft tissues like a buccal mucosa, sublingual tissue and the tongue sidewall. Consequently, it achieves suction.

That is to say, two different concepts make a change of the denture techniques.

Now let's focus on the lower complete denture suction.

First of all I would like to state my opinion.

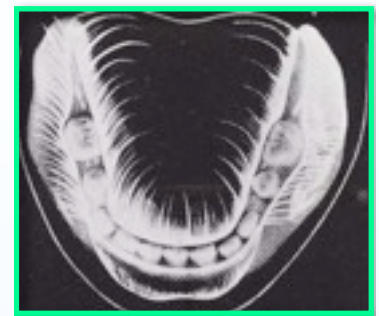
The most important aspect of my technique is the understanding of the suction denture mechanism. because there are dentists in the world that can not access high quality materials from Ivoclar Vivadent. Thus they have to use local materials that are available.

Of course we know using high quality products helps us to fabricate suction dentures in our practices.

**(Question) What is the most important requirement of the suction denture?**

Regardless whether it is on the upper or lower jaw, the absolute requirement of complete denture suction should be complete sealing of denture borders.

Now, let's look at the mechanism how the denture border is closed.

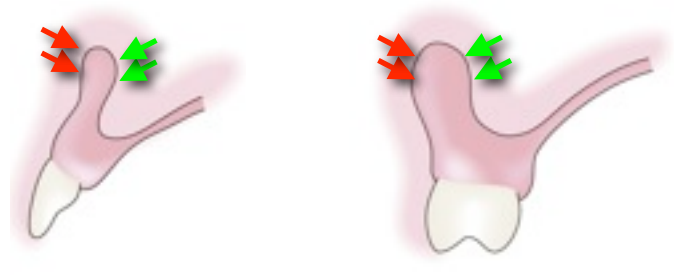


*What is the most important requirement of the suction denture?*

*The answer is simple and easy. It is complete sealing of the denture border.*

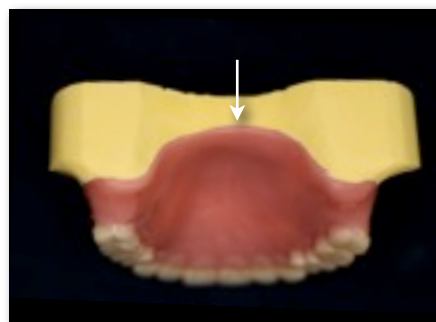
*The purpose of the suction denture in the mandible is to seal the entire border of the denture with the oral soft tissues like a buccal mucosa, sublingual tissue and the tongue sidewall. Consequently, it achieves suction.*

# The explanation of the closure for the maxilla



## 1-1. The interior/exterior doubled closure

First we look at the closure of the upper jaw including the lips, premolars and molars. Take a look at the blue lines. The closure of this area is called «the interior/exterior doubled closure». I mean that the interior surface of the denture in these areas indicated by the green arrows has contact with the mucous membrane. Next, please focus on the red arrows. Now the exterior surface of the denture border has contact with the lip tissues or the buccal mucosa. In other words, the denture borders are very much closed with the interior and exterior surfaces. So, it looks very easy to close them.

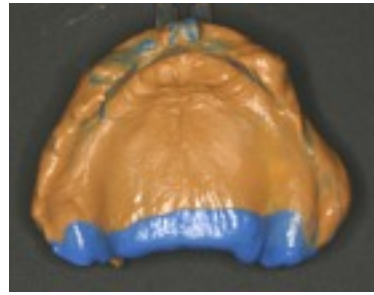


## 1-2. The close contact closure

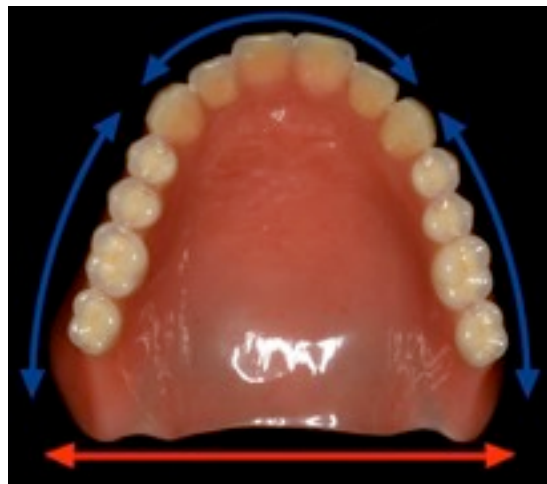
Now, we go to the closure of the palatal posterior border.

The most difficult sealing area for the maxilla is the palatal posterior region. In this region, the closure is complete with close contact of the denture border interior surface and the palatal mucosa. This is called a close contact closure.

This kind of closure type is very delicate, and if air enters into this area, then the closure would break down very easily. If any space is created between the denture interior surface and the mucosal ridge beyond the sealing power of the saliva tensile force, the closure would break and the denture would drop down.



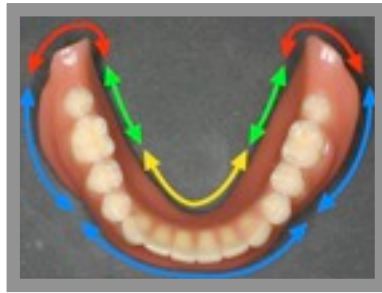
Normally in clinical cases we make the post dam on this area for a better closure. On your left, is the figure to make the post dam on the plaster model after the impression. On your right, is the figure to make the post dam during the impression.



### 『In conclusion of the upper denture closure』

The closure mechanism of the upper denture is comprised with the interior ,exterior doubled closure and the close contact closure.

## 2. The explanation of the closure for the mandible



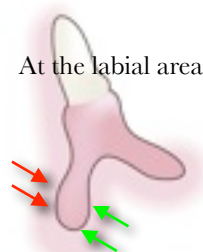
Although the closure mechanism of the upper denture is clear, the lower denture closure mechanism is rarely explained. I personally believe that I might be the first person in the world to clarify the mechanism of the lower denture closure. We now go to the sealing mechanism of the lower denture. The lower jaw is more complicated than the upper one and it is comprised of four different types of closures.

First the blue arrows indicate the interior exterior doubled closure.

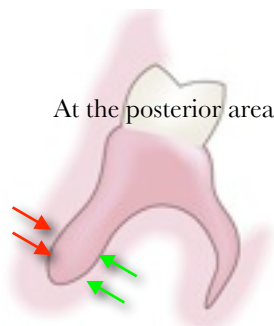
Secondly, the yellow arrows indicate the single sided complete closure with the sublingual tissues and the green arrows indicate the compensatory closure at the retromylohyoid muscle fossa.

The last is the close contact closure with the interior surface of the denture and the retromolar pad tissues and the closure on the retromolar pad with the buccal mucosa and the tongue side wall that are indicated by the red arrows.

### 2-1. The explanation about the interior exterior doubled closure for the mandible.



At the labial area



At the posterior area

As for the closure of the lower lips and buccal areas, it should be the interior/ exterior doubled closure that is indicated by the blue arrows.

The exterior surface of the denture has contact with the labial mucosa at the front area and the buccal mucosa at the posterior area.

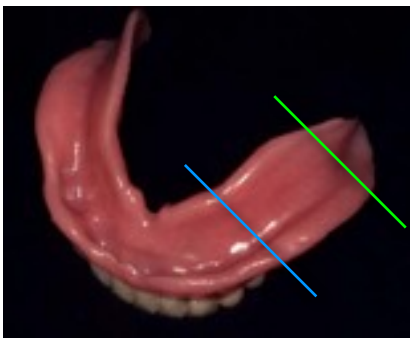
Then the interior surface of the denture has contact with the residual mucosa. So, this closure is strong and stable like a sandwich.

## 2-2. The explanation about the closure of the lingual area.

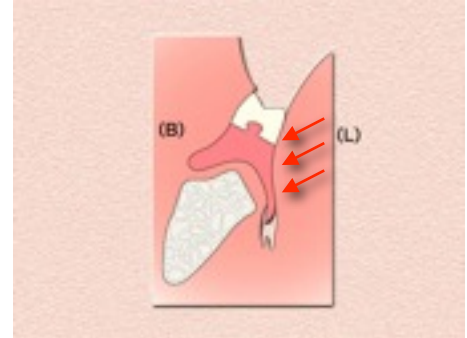
I can distinguish the closure at the sublingual area from the closure at the retromylohyoid muscle fossa area.

The figure below, in your center is the cross-section shown as a blue line at the sublingual fold. It is more effective for suction than the retromylohyoid muscle fossa.

The figure below, on your right is the cross-section shown as a green line. You can see the space under the denture border. The denture border of the retromylohyoid muscle fossa does not associate with the lingual mucosa. It's not a real closure. So it is called the compensatory closure.



at the sublingual mucosa



at the retromylohyoid muscle fossa

### 2-2-A) The case with spongy tissues

The explanation about the closure at the sublingual area that is called the one sided complete closure. The sealing power would be changed due to the existence of a spongy tissue at the sublingual fold.

In case this sublingual fold area is rich with spongy soft tissues indicated by the white arrows, the mechanism belongs to the interior/exterior doubled closure.



The spongy tissue



at the mouth closing



at the mouth opening

In your center the figure is the condition at the closed mouth, on your right the figure is the condition at the mouth opening.

The lingual mucosa comes in contact with the denture border at the blue part. It does not change even when the tongue moves at the mouth opening.

So this closure is very stable and strong.

In this case, when the sublingual mucosa moves on the one-sided surface, the vacuum in the lower denture will be maintained.

The closure would not be compromised even when the tongue moves backward at the mouth opening.

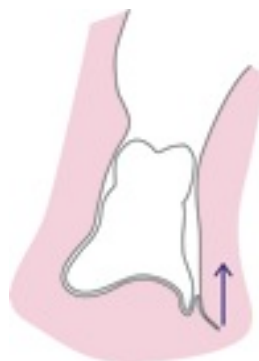


## 2-2-B) The case with non-spongy tissues

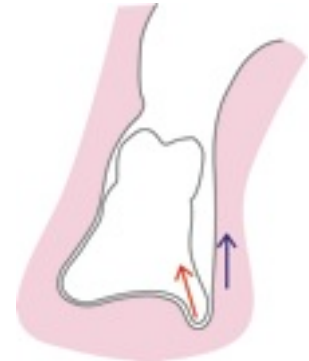
On the contrary this is the case when the sublingual fold area is lacking spongy tissues. In such a case, it is difficult to achieve suction often.



Non- spongy case with highly bone resorption



at the mouth closing

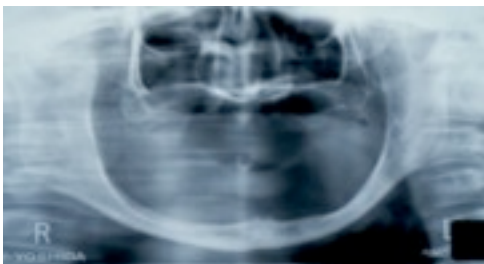


at the mouth opening

The closure would break down easily by the smaller sealing area at the sublingual fold after the tongue moves backward at the mouth opening.

Then we have to make efforts to take an good impression.

As shown on the X-ray, unfortunately if the patient does not have the spongy tissues with tremendous bone resorption, it is effective that the sublingual denture border of the individual tray should be thickened horizontally like the web of a frog in order to increase the denture sealing area.



Tremendous bone resorption

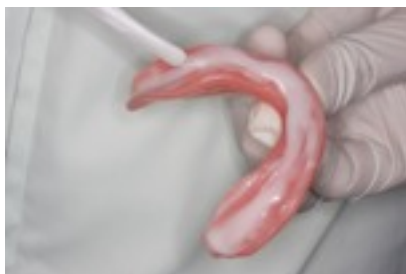


Horizontally denture border extension



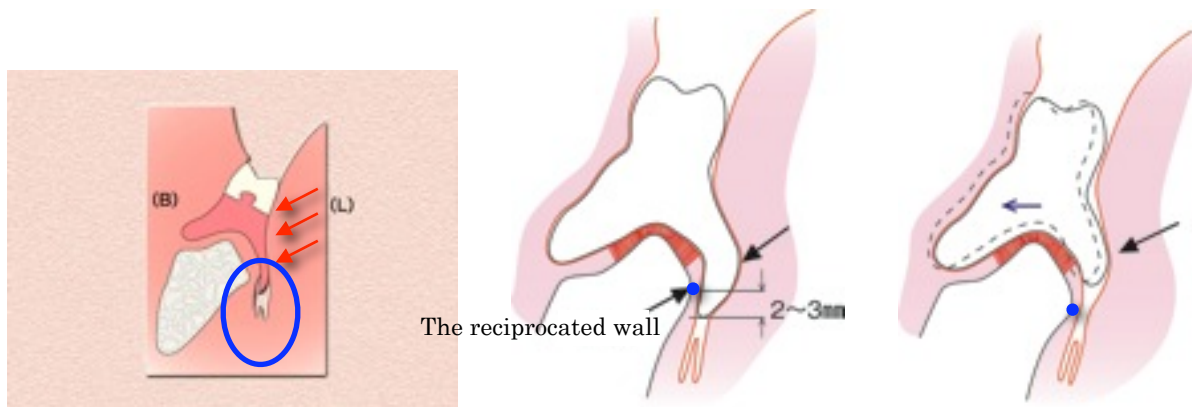
Still non-suction, the treatment denture should be fabricated before the completion.

The treatment denture with tissue conditioner materials would be better to be adjusted as a functionally dynamic impression until obtaining denture suction and the occlusal stabilization.



Treatment denture with tissue conditioner materials for dynamic impression

## 2-3) Explanation of the compensatory closure around the the retromylohyoid muscle fossa.



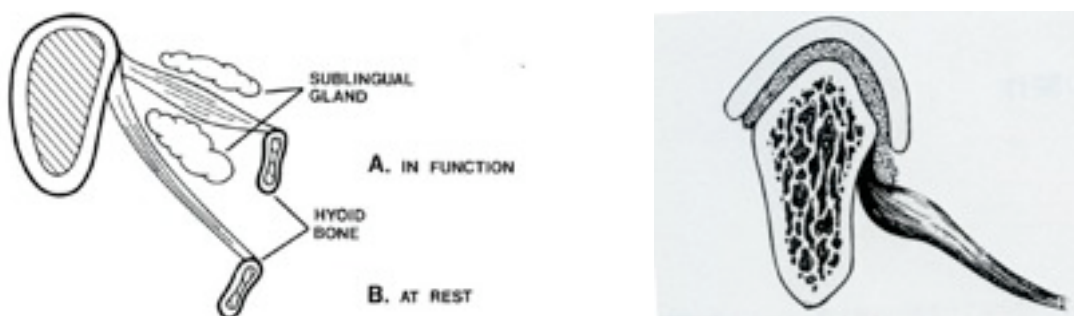
The border of the retromylohyoid muscle fossa cannot be achieved with the sealing of the denture base border and the mucosa, because you can see the space encircled by a blue line under the denture border every time.

So, it is not real closure.

It's called the compensatory closure that is attained with the tongue sidewall by applying pressure to the denture underneath.

And also the reciprocated wall against the tongue pressure is essential to achieve the compensatory closure. The center figure shows us the sufficient denture border to complete the compensatory closure.

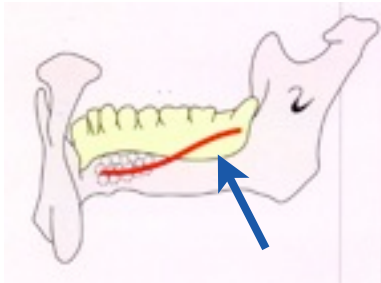
On the right figure, The denture border has stopped on the mylohyoid line and slides easily by the tongue pressure.



Nagel, R. J., and Sears, V.H. :  
Dental Prosthetics, St Louis : The Mosby Co., 1958.

As an objective opinion of the over-extension, Dr. Nagel reported that the extension over the mylohyoid ridge interrupts the movement of both tongue and mylohyoid muscle and the function of the sublingual gland. I would like to conclude that the less border extension over the mylohyoid line would permit the denture dislodgement.

At present, as for anatomical reports on the retromylohyoid muscle fossa, it is concluded that the denture base can be extended inferiorly over the mylohyoid muscle attachment, because the muscle fibers run in the antero-inferior direction even at the maximum contraction of the mylohyoid muscle.



atomic condition



contractional condition

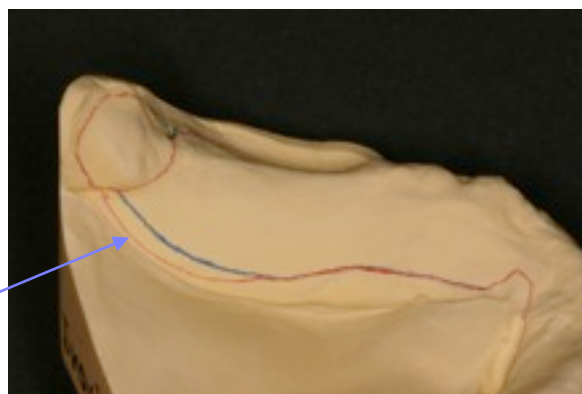
What is the adequate extension of the denture border for the edentulous patient?

If you want the denture border to be extended down 1cm you can do it easily. However It is a fact that the excessive denture border extension will permit the denture flip-up that is forced by the mucosal response at the lingual tissue function.

So I recommend that whether the residual ridge is good or bad, the outline of the custom tray should be extended at least 2~3 mm over the mylohyoid muscle line in order to achieve entire border sealing including the compensatory closure.

As a result, the adequate extension of the denture border over the mylohyoid muscle line depends on the patient's oral condition and it would be determined individually by the functional precision impression.

at least 2~3mm extension



Outline of the custom tray



### 3. Explanation of the posterior closure around the retromolar pad.

Finally we go to the closure around the retromolar pad.

I think that it is a key-point for readers.

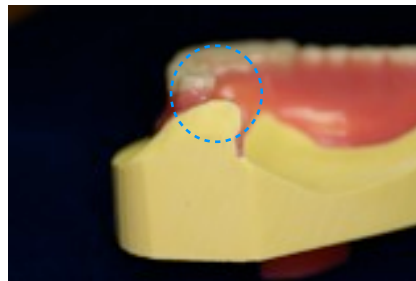
The closure of the retromolar pad is comprised of two kinds of closure.

3-1). Close Contact Closure with the interior side of the denture and the retromolar pad where is encircled by the blue line in the center figure.

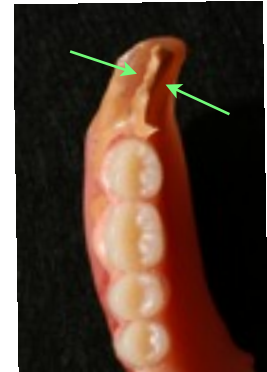
3-2). The Exterior Closure over the denture base by the close contact with tongue side wall and buccal mucosa which is pointed out by the green arrows on the right figure.



The closure around the retromolar pad



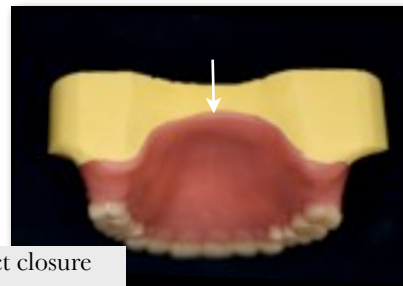
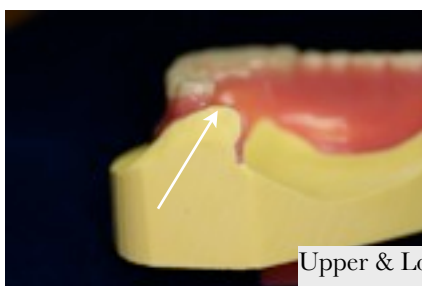
Interior Closure



Exterior closure

#### 3-1). The explanation about the Close Contact Closure with the interior side of the denture and the retromolar pad

The close contact closure of the denture interior side in the retromolar pad is identical to the upper palatal posterior region. But the contact area of the retromolar pad is extremely small when compared with the upper palatal area.



Upper & Lower close contact closure

For this reason, the closure of this area should be especially taken care of.

And the retromolar pad would be easily deformed by the impression pressure.

It is very important for the better closure to take an impression of the natural and static shape of the retromolar pad at the closed mouth as a preliminary impression.

A preliminary impression has been known to record a sufficient number of jaw anatomical landmarks, and so this impression size tends to be larger than a denture space that originally is required. This preliminary impression in the past had problems where one operator would take different impression records from the same patient.

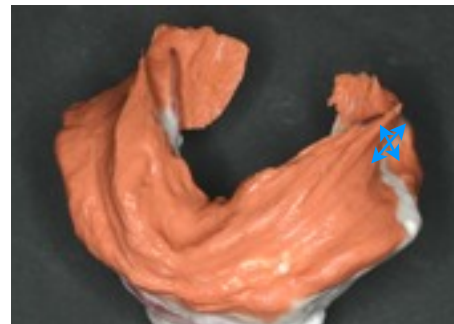
Moreover, the same operator could take many different preliminary impressions.

So, I have been considering a preliminary impression technique to solve these problems for several years and I developed Frame Cut Back Tray.

The accu tray-gel from Ivoclar Vivadent is hard impression material. We factually notice that the hard material will press against the gums. As follows, on your left, Accu syringe-gel and tray-gel are mixed with the normal liquid powder ratio. On your right Accu tray-gel is mixed with more water contrary to the normal rate with Frame Cut Back tray. As a result, the height of the retromolar pad will drop down and expand outwards. As shown on these figures the left pictures have larger retromolar pads than the right pictures.



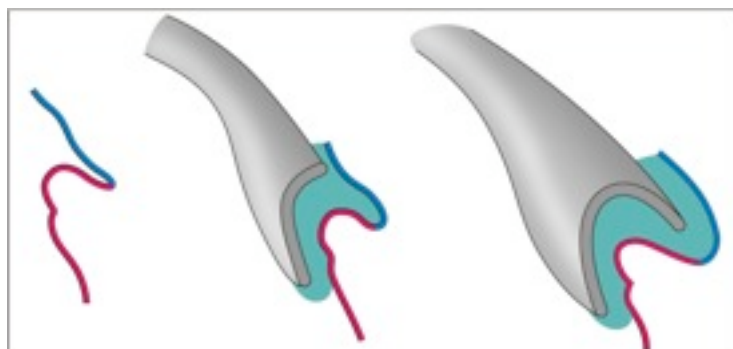
Accu System



Accu gel and tray gel with  
Frame Cut Back tray



On your left is the figure from the backend view of the retromolar pad .  
 In your center ,when the frameless tray with soft alginate impression material is inserted into the mouth the mobile buccal mucosa would not be forced to expand. On your right when the Accu tray with Accu tray-gel is inserted into the mouth the mobile buccal mucosa would be forced to expand.  
 This impression size tends to be bigger than the original denture space.



The natural shape of the retromolar pad

alginate impression materials with Frame Cut Back tray

Accu gels with Accu tray

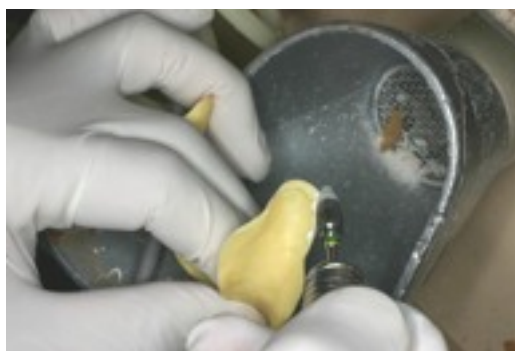
This is my advice. If the Accu system is used in your practice it would be necessary to make an adjustment to the individual tray.

The excess part of the individual tray before the precision impression is removed.

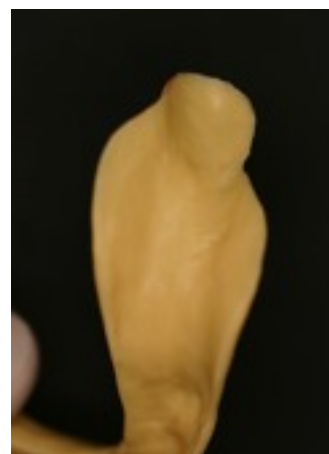
I want to say again that it is very important for the better closure to take an preliminary impression of the natural and static shape of the retromolar pad with Frame Cut Back tray at the closed mouth.



Test with disclosing paste



The excess part of the retromolar pad should be removed.



Proper retromolar pad shape of the custom tray

## Frame Cut Back Tray for preliminary Impression

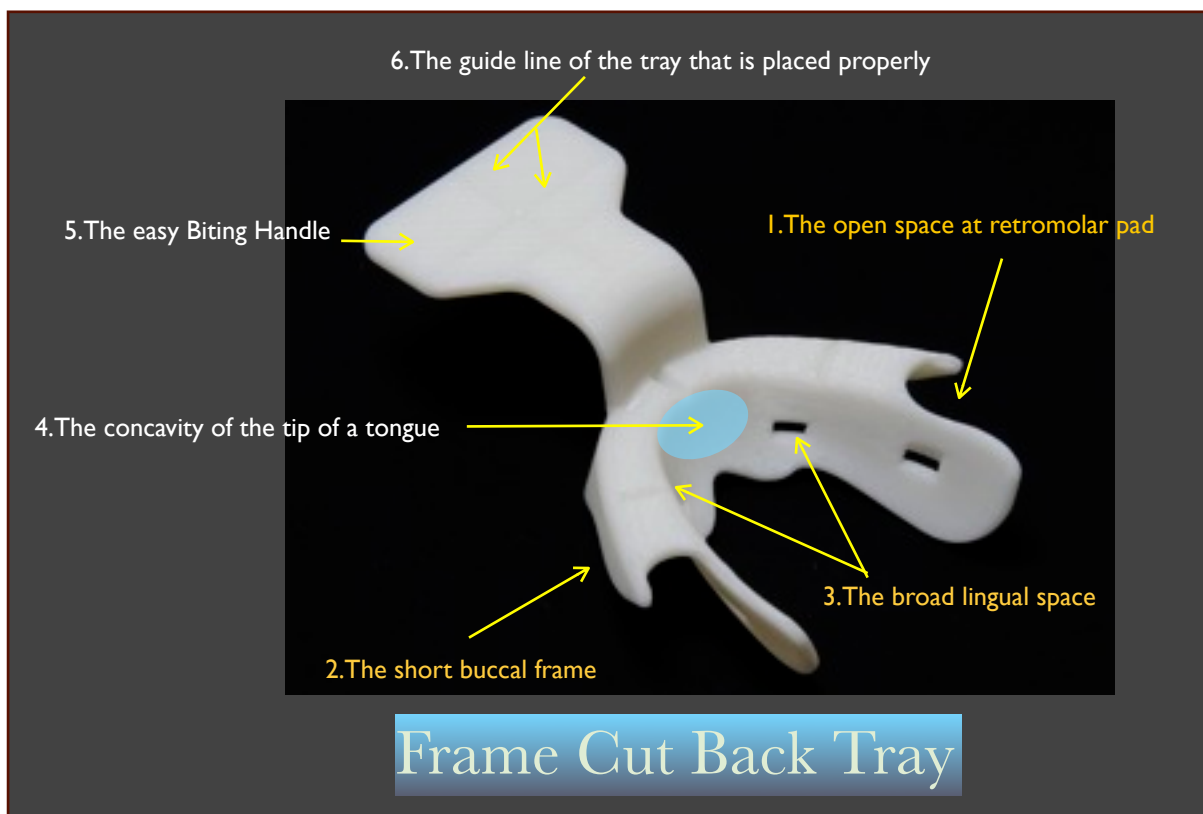
So I have already developed the Frame Cut Back tray for a static impression technique. The Frame Cut Back tray started by modifying dentulous tray to remove a part of the frame.



Based on principles of suction mechanism of lower complete denture, a preliminary impression should be taken using the “Frame Cut Back Tray” specially and a custom tray should be fabricated for final impression taking being joined with full ideas of achieving suction effective retention.

Frame Cut Back Tray overcomes the disadvantages, avoids the deformation of the natural shape of the retromolar pad and the excessive expansion of the buccal mucosa. Moreover the same sized and shaped preliminary impression can be taken by any dentist.

It will be available on the market in April, 2010 by MORITA CORPORATION.





## 【 Frame Cut Back Tray impression technique with Accu gels】

### -Static & Closed Mouth Impression Technique-

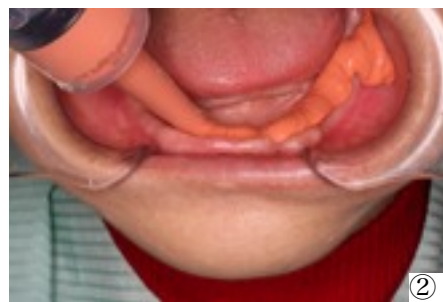
First ,confirm the location of the retromolar pads and carry the Accu syringe gel via a syringe. Inject in sequence of the retromolar pad ⇒ lingual area⇒ the retromolar pad ⇒ muco-buccal fold. ①~④

Next, the Frame Cut Back Tray with Accu tray gel is inserted into the mouth. Rest the tongue lightly on the tray, slowly close the mouth and hold the handle for it to set for a while. ⑤~⑦

Do not force and push the tray so that the impression of the original oral cavity space can be taken.

The operator rubs the cheeks upward while waiting to set. ⑧

This motion prevents the built up of the impression material within the cheeks.



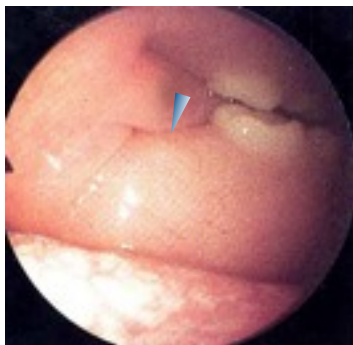


### 3-2.The explanation about the exterior closure over the denture base by the close contact with the tongue side wall and the buccal mucosa.

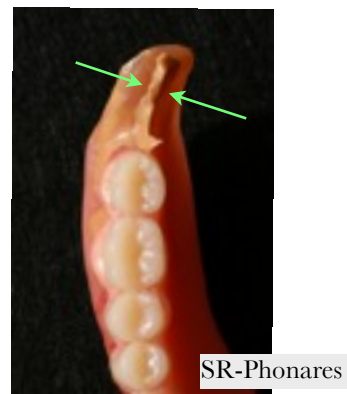
How is the posterior border seal made?

Regarding the posterior end seal over the retromolar pad, it has been clarified by Dr.Onoki's endoscopic observation.

From his observation, we have known that the denture base over the retromolar pad is mounted with the buccal mucosa in the closed mouth, exerting downward force toward the base.



The courtesy of Dr. Onoki



The exterior closure over the denture base by the close contact with the tongue side wall and the buccal mucosa at the retromolar pad from the observation with disclosing paste.

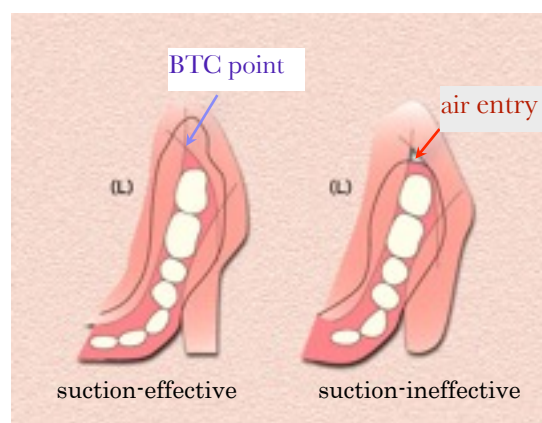
In addition, the tongue sidewall and the buccal mucosa have close contact in about one third of the posterior area of the pad.

I named it BTC point: Buccal mucosa, Tongue side wall, Contact point.

In fact, the seal is not perfected unless the denture border stops before the cheek and tongue contact area.

On your left the base covers the denture base with BTC point on the pad. It is suction-effective .

On your right the denture border has stopped before BTC point. Then the posterior end seal is imperfect without coverage of the retromolar pad. It is suction-ineffective .



# How is the BTC point created?

## Endoscopic Video

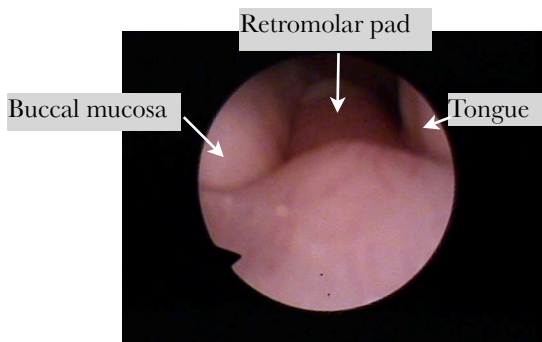
This is the additional experiment I conducted.

The copy denture was accommodated due to the observation with the endoscope.

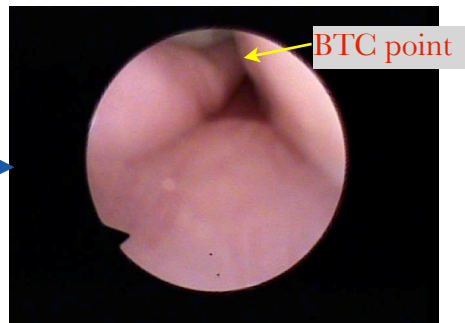
I tried to observe the variation around retromolar pad.

BTC point is observed on the retromolar pad at the mouth closing.

Consequently, BTC point permits the posterior seal.

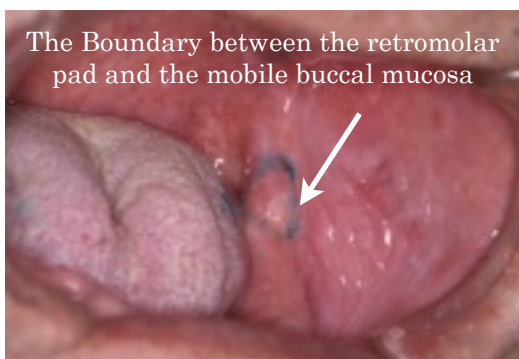


At the mouth opening



BTC point is appeared at the mouth closing.

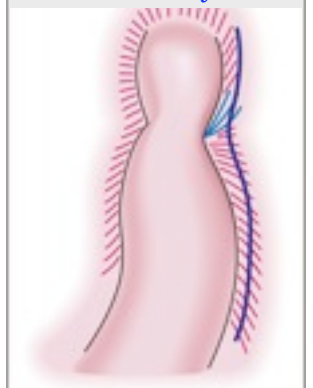
According to the exterior closure of the denture base, I suggest one more important point. As for acquiring BTC points we will take care of overdrawing the outline of the custom tray. Please take a look at bellow pictures. It is observed that the white allow head indicates the boundary between immobile retromolar pad tissue on your left and mobile buccal mucosa and the mobile buccal mucosa covers the retromolar pad at the closed mouth in your center. On your right, if the custom tray would cover the mobile buccal mucosa beyond the boundary that is indicated by the blue line, the excessive expansion would increase the denture flip-up that is forced by the mucosal responses at the opened mouth.



The Boundary between the retromolar pad and the mobile buccal mucosa



Do not expand the custom tray over the boundary!



I think that over-expansion of the buccal mucosa permits the denture mobility at the mouth opening. We will take care of over-drawing of the outline of the custom tray.

So, I recommend that the natural shape around the retromolar pad should be taken by means of the Frame Cut Back tray in order to avoid the excessive expansion during preliminary impression taking.

### Check experiments

#### What factors obstruct the creation of the BTC point?

These are the check experiments.

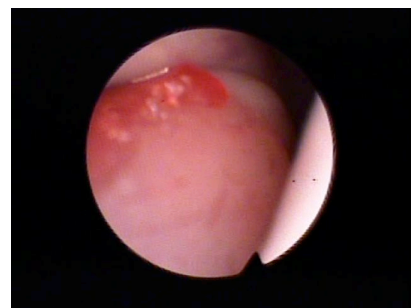
The red wax molds an excessively large outline on the buccal shelf.

The posterior seal would be broken easily without BTC point .



Next, the red wax molds an excessively large outline on both buccal shelf and lingual border.

BTC point is not apparent.



If you want the denture border to be extended down 1cm you can do it easily. An excessive outline of the buccal and lingual sides means the increase of the denture bearing zone.

However, from these experiments, we should consider avoiding excessive lingual extension and buccal expansion in order to create BTC point or complete the posterior end seal.

## Basic outline of the custom tray for the Lower Suction Denture

The plaster model with Frame Cut Back tray technique is one of the static impression model to achieve suction.

Especially, we will take care of drawing the outline of the custom tray around the retromolar pad area as follows.

### 1. Retromolar pad

Full coverage of the retromolar pad is essential to complete the posterior end border seal including BTC points.

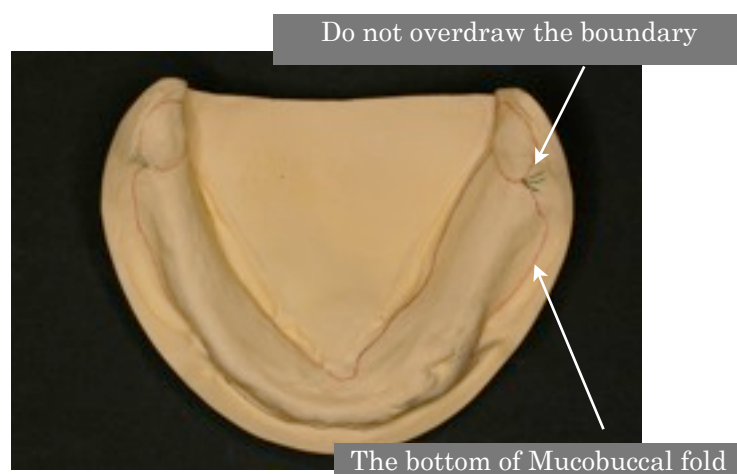
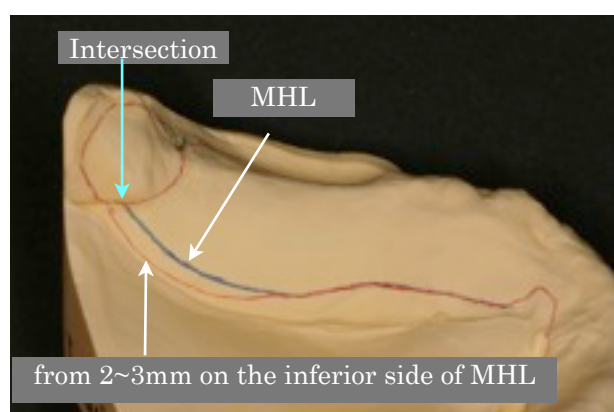
### 2. Lingual area

The outline starts from 2-3mm behind the intersection where the Mylohyoid Line(MHL) meets the retromolar pad. It runs 2-3mm on the inferior side of the MHL until the first molar area. Because the excessive extension over MHL might permit the denture flip up. The final denture border will be determined individually by the precision impression.

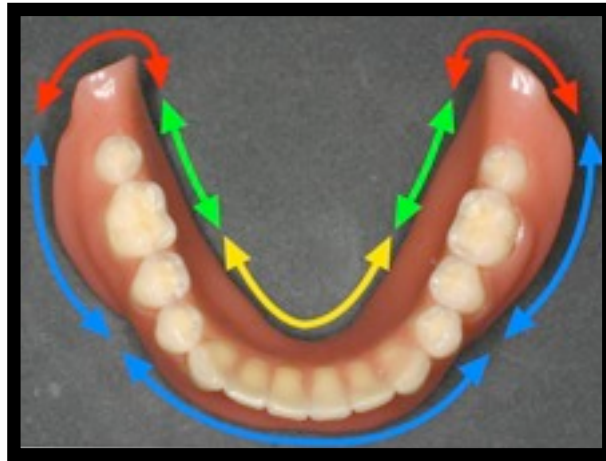
### 3. Buccal area

The outline should be drawn on the bottom of the muco-buccal fold at the lower buccal posterior area to not expand the buccal mucosa excessively.

Please do not expand the outline over the boundary between the retromolar pad and the buccal mucosa at the area of the retromolar pad.



[[In conclusion of the closure for the mandible]]



The closure for the mandible is very complicated. The absolute requirement of complete denture suction should be complete sealing of denture borders. Do not ever make even one instance of the air-entry within the interior side of the denture. If sealing is not perfect even in one place, the lower denture will flip up.



## Fabrication of the custom tray for the lower suction Denture

We need to make a special custom tray of precision impression to create BTC point with the tongue side wall and the buccal mucosa over the denture.

The custom tray that I make is designed with an innovative idea, because it is essential for the denture to make a perfect closure and fulfill suction.

Please check 6 special points with Bio-functional prosthetic system as follows.

1. The retromolar pad is covered thinly following the natural shape to create BTC point with ease.
2. Avoid the sinew string at the buccal base of the retromolar pad to create BTC point with ease.

### What is the sinew string?

In posterior region to the lower second molar, there is always a space existing even in a normal individual. Despite this, however, there is no chance of food deposit in the space while eating, because this sinew string works to pull the buccal mucosa strongly to the lingual side, carrying food bolus toward tongue surface skillfully.

Even if the sinew in the mouth cannot be visible, the buccal mucosa is always pulled within the lingual side distal to the lower second molar tooth by the oral negative pressure on swallowing. Thanks to this function, we humans can live normal eating habits without leaving food bolus distal to the lower second molar teeth.

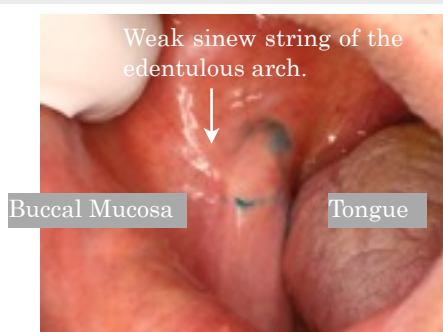
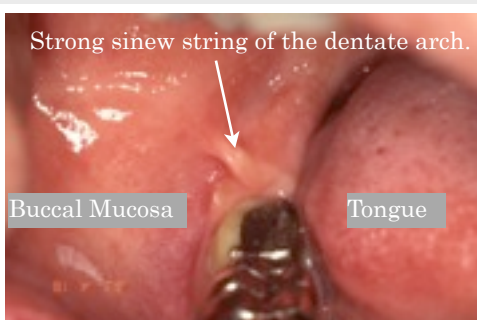
Regardless of whether this string is clearly visible or not, it would be better to avoid it as we avoid the frenum seen at the premolar teeth area when the custom tray is fabricated. So the buccal mucosa would help to mount more easily onto the retromolar pad and to induce more sealing power.

Even if the edentulous jaw demonstrates a sinew-like strong quality, or even a frenum-like quality, it is only the tissue rich in collagen from the histological view, and absolutely not any tissues such as tendons or muscles.

#### ❖ Reference of Sinew String

Seiichiro Someya Journal of Practice in Prosthodontics, Vol.30 No.1, 1997 (Japanese).

Jiro Abe: Journal of Dental Outlook, Vol.110, No.5:846~853, Vol.6:1021~1027 Japan 2007.



Courtesy of Tokyo Dental College

The sinew string works to pull the buccal mucosa in the lingual side.

Histological finding:  
Collagen rich tissues

3. Buccal shelf is modeled in concavity progressively toward the retromolar pad. It is effective that the retromolar pad is covered with the buccal mucosa easily.
4. The occlusal plate rests slightly in the center of the ridge width but alveolar crest line.
5. Adequate space is provided to accommodate tongue movement.
6. Right and left lateral incisor area is shaped in concavity. It permits the lower lip support.

**I recommend the fabrication of the special custom tray for suction denture with beneficial advantages of BPS: Bio-Functional Prosthetic System from Ivoclar Vivadent.**

Centric tray



Centric tray with Accu tray gel



Gnathometer M



Mounting of custom tray



1. Retromolar pad is covered thinly

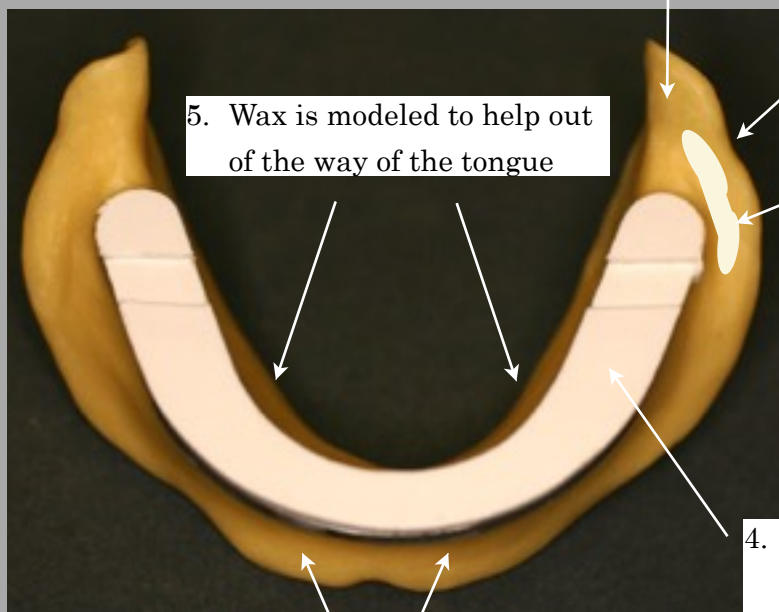
2. Avoid sinew string

3. Buccal shelf is modeled in concavity

4. The occlusal plate rests slightly in the center of the ridge width

6. Right and left lateral incisor area is shaped in concavity

5. Wax is modeled to help out of the way of the tongue



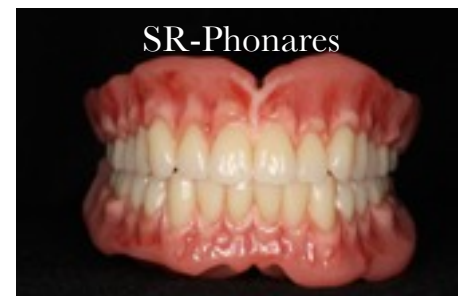
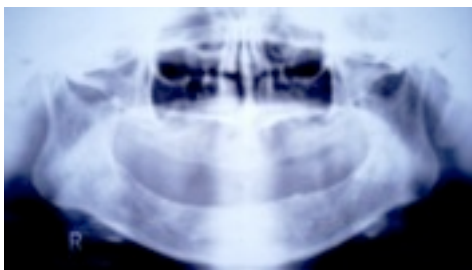
## The case of good ridge form with occlusal stabilization :

### Instruct to do the basic 5 movements

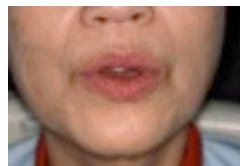
#### Oral movements for closed mouth functional impression

There are many movements necessary for functional impression. To take an impression of the lips and cheeks, soundings of “woo”, “eee”, and “oooh” were originally effective, but the sounding of “oooh” made the tray flip up from the residual ridge and disturb the impression. And the quick and large tongue movements right and left also made the custom tray unstable. From these various reasons, movements for impression were kept to a minimum. And we now practice the following of fivefold movement as basic impression movements.

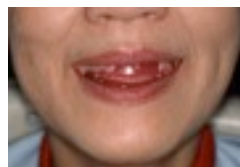
1. Tighten the lips. (2 ~ 3 times)
2. Sound “eee”. (2 ~ 3 times)
3. Move the tongue across the upper lip (1 time): Lingual movement
4. Push the backside of anterior wax rim with the tongue. (1 time): The movement is to release the denture flip-up caused by the mylohyoid muscle, and Passamonti's notch is taken in the impression.
5. Swallow. (1 ~ 2 times): Total impression molding of 1 ~ 4 and negative pressure functional movements in the whole oral cavity.



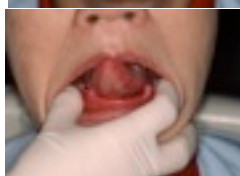
1. Tighten the lips.



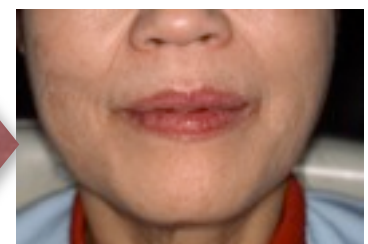
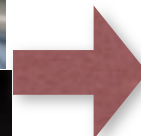
2. Sound “eee”.



3. Move the tongue across the upper lip.



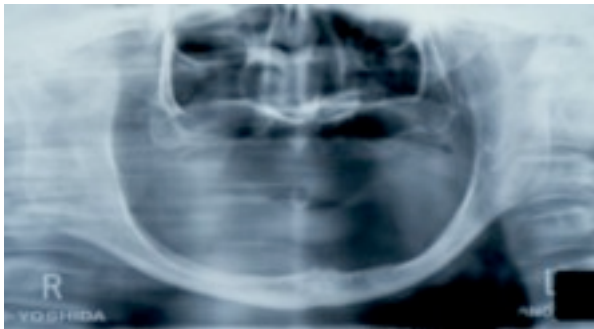
4. Push the backside of anterior wax rim with the tongue.



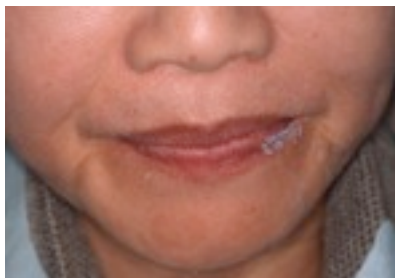
5. Swallow.  
(2 ~ 3 times)

## The case of poor ridge form with occlusal stabilization : Instruct to do the basic 2 movements

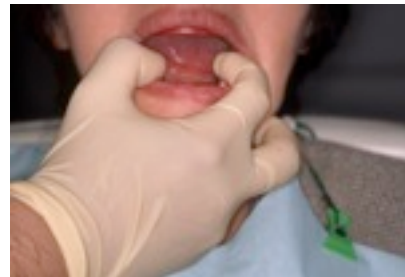
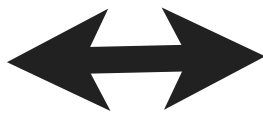
But for difficult cases, these five movements become rather hyperactive and cause difficulty for the suction to occur. For difficult cases, movements for taking impressions will be mainly done of only two movements, such as “swallowing” and “holding the tray at the mouth opening”.



Vivodent DCL : Ivoclar Vivadent



1.swallowing



2.holding the tray at the  
mouth opening