Original report

Difference between Provider Centric Approach and Patient Centric Approach in Complete Denture Impression

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This paper reports the comparison of impression design between the following two techniques: an open-mouth impression technique with a provider centric approach, which is a mandibular complete denture impression technique involving border molding for separate blocks with the use of a compound; and an impression technique with a patient centric approach, which involves impression molding in a closed-mouth position during which the patient himself/herself is allowed to perform functional jaw movement for the attachment by suction of mandibular complete denture. The results for comparison and observation revealed that there are characteristic differences relative to individual parts in the mouth. Based on such characteristics, it is suggested that the impression technique with a provider centric approach is focused on the support of a mandibular denture and thus is intended to extend a denture base while keeping the supporting tissue free from functional problems, and that the impression technique with a patient centric approach involves the attachment by suction of a mandibular complete denture to residual ridges and thus is intended to sufficiently fill a defect space with a denture.

Key words: Complete denture, Provider centric approach, Patient centric approach

Introduction

A variety of impression techniques are available for construction of mandibular complete dentures and the aim of this study was to compare what impression mold morphology was taken from difference of impression technique.

Two different approaches of impression taking were studied. One method was an open-mouthed taking after the borders were molded with separate blocks of impression compound, as coined "Provider Centric Approach"[1-2]. The other method was a close-mouthed taking, as coined "Patient Centric Approach". That is, functional jaw movements were performed primarily by patients themselves so that suction effect of mandibular complete dentures could be finally established[3].

These two different impression takings were performed on an identical patient, and as a result, morphology characteristics became evident in specific anatomical regions. And these differences were carefully discussed in this report.

Research Method and Materials

A maxillary and mandibular edentulous patient (age of 72 years, female) was processed with two different impression technique for construction of complete dentures. One was that of border molding performed by the author, who was of background of 12 years after graduation from a school of dentistry and with a five-year experience of researcher at a department of prosthetics of removable denture, using modeling compound material and custom impression tray made with acrylic resin, as it was called "Provider Centric Approach" (hereafter called Provider C.A.). The other method was taken by asking the patient to perform functional jaw movements using a custom impression tray made with a base plate built with wax occlusion rim, called "Patient Centric Approach" (hereafter called Patient C.A.).

Prior to taking final impression with these two approaches, preliminary impression was taken for making primary stone casts that were used to fabricate custom trays. Primary impression for Provider C.A. was taken with a stock tray for making complete denture (Ami-tray, Hayashi Dental Supply Co.) additionally corrected on the rim of tray with Utility Wax (GC Co.). A dental alginate impression material (Aroma Fine DF Ⅲ , GC Co.) was used. As for Patient C.A., primary impression was taken with a frame-less tray specified under Abe's report 4) (IN-type Tray modified, Dentsply Sankin Co.) An alginate impression material (Aroma Fine DF Ⅲ , GC Co.) was used together with an injecting syringe (Terumo Syringe 50ml, ss-50Cz)(**Fig.1,2**).

Based on these impression stone casts, custom tray outlines were drawn, and the custom tray for Provider C.A. was prepared and the other one for Patient C.A. was made added with wax occlusion rim (**Fig.3**).

The custom tray outline for Provider C.A. was established around 2-3 mm inside than the final denture periphery by taking into account of the thickness of added compound (upper right blue line in **Fig.3**) (or otherwise about 3-4 mm inside from the reflection of the mucous membrane) (upper right red line in **Fig.3**). The buccal flange outline of final denture fabricated through the procedure Provider C.A. was to be established so as to pass over the external oblique line, although the exactly established line would greatly depend on resistance capacity of tissues surrounding the flange area. And the lingual flange outline was set up based on the reflection of the mucous membrane that was taken on the snap impression cast. The outline was extended posteriorly to the mylohyoid muscle fossa (**Fig.4** upper left). The custom tray outline for the Patient C.A. procedure was based on the border between movable and nonmovable tissues (lower right red line in **Fig.3**). Particularly in this case, the buccal flange of the tray had an outline drawn on the flat area lying from the ridge crest down on the buccal side

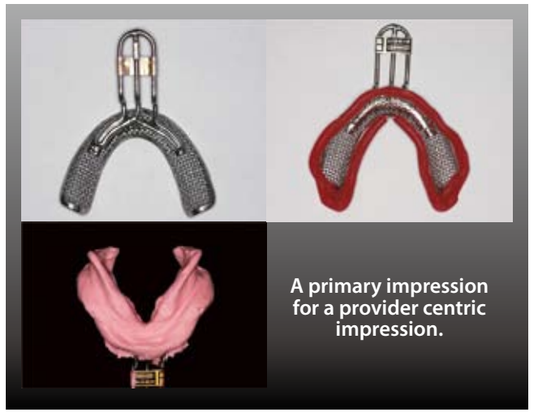

Fig.1 A stock tray was modified with utility wax for taking. A primary impression for a provider centric impression taking method.

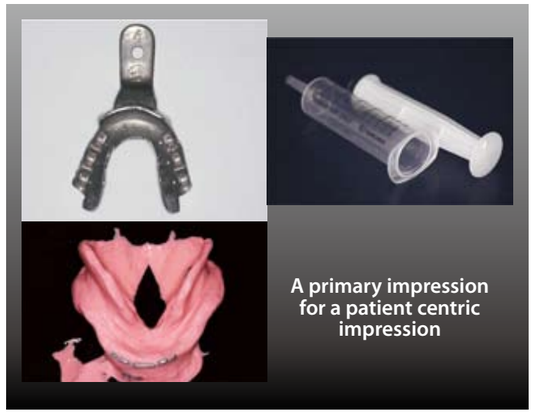

Fig.2 A frame-less tray and injection syringe were used. A primary impression for a patient centric impression taking method.

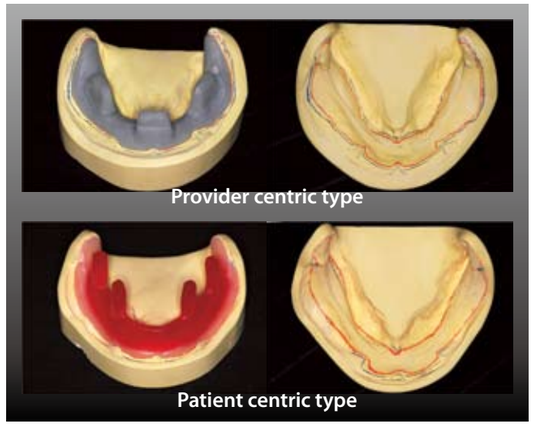

Fig.3 Diagnostic stone models and custom trays of a provider centric type and a patient centric type.

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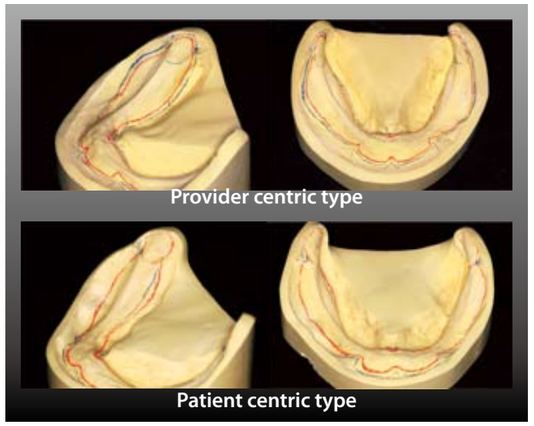

Fig.4 Different custom tray outlines of a provider centric type and a patient centric type.

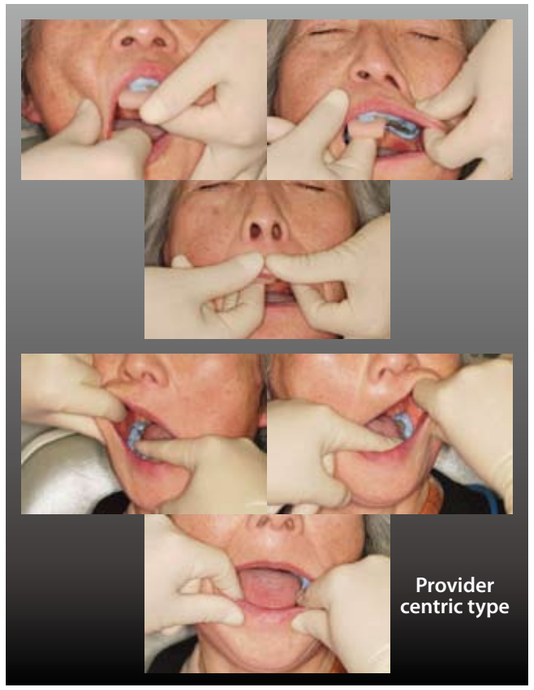

Fig.5 Border molding in blocks with impression compound.

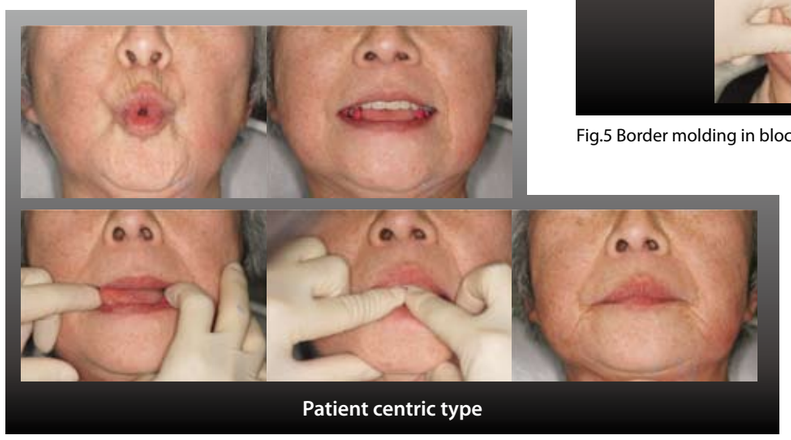

Fig.6 Basic five actions for close-mouthed functional impression.

slope to the horizontal plane. On the lingual flange of the tray, the outline started from the spot around about a third or a half of the posterior portion from the retromolar pad, and this line ran 2 mm below the mylohyoid muscle line toward the anterior region, and it combined in the medium with the mylohyoid muscle line (**Fig.4** lower left). And this line in the anterior region of the mandible was fixed 2 mm above the muco-buccal fold and its floor base (**Fig.4** lower right). In the procedure Patient C.A., however, the outline was not extended to the mylohyoid muscle fossa posterior to the retromolar pad, contrary to the line in the procedure Provider C.A.

As for the final impression of Provider C.A., after a partial border molding was performed with impression compound in separate blocks following Boucher's protocol[1] (**Fig.5**) by cutting the tray margin in about 1.5 mm shorter entirely except the retromylohyoid muscle eminence and by reducing the inner surface of the tray about 1.0 mm thinner except the retromylohyoid muscle eminence as well as the buccal shelf area, an open-mouthed impression was taken with a silicone impression material (Exadenture, GC Co.).

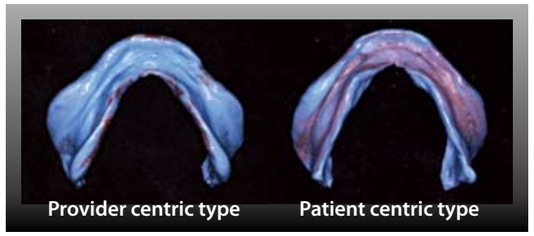

Fig.7 Different thickness of impression material on the impression molds.

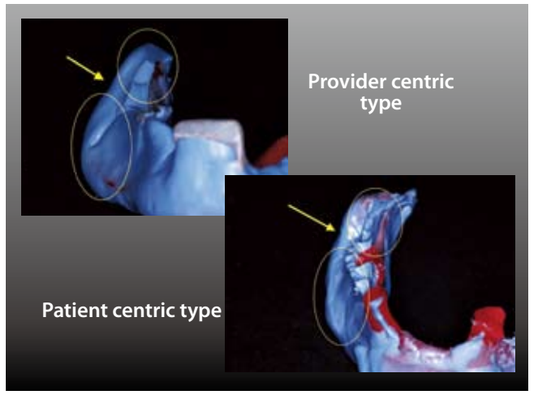

Fig.9 Different impression molds of buccal mucosa and presence and absence of slit cut on the external side of anterior margin of the pads

In the procedure Patient C.A., following Abe's protocol[4], primary impression was taken with a silicone impression material for border molding (Exadenture Border type, GC Co.) and secondary impression with a silicone impression material (Exadenture, GC Co.). Throughout both takings, basic five actions were performed under a patient centered guidance, including actions of 1. to tighten lips, 2. to sound "eee", 3. to move the tongue across the upper lip, 4. to push the backside of anterior teeth, and 5. to swallow (**Fig.6**).

The impression molds were taken through the procedures described above and investigated as in the following manners.

I. Comparison of each impression shape taken under the protocol of Provider C.A. and Patient C.A. by the author, who was of background of 12 years after graduation from a school of dentistry and with a five-year experience of researcher at a department of prosthetics of removable denture at a dental university.

II. Patient C.A. was performed twice by the identical patient under the author's supervision and the impression shape differences were compared.

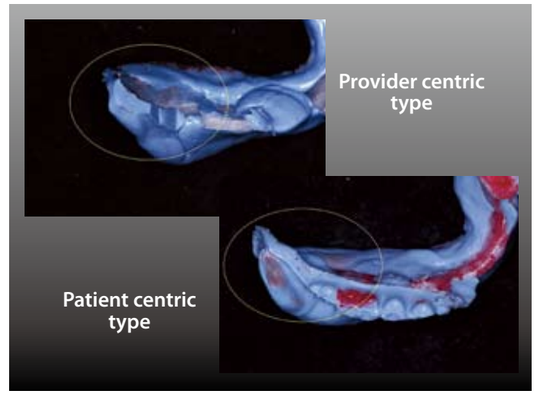

Fig.8 Different impression molds of tongue side wall and buccal mucosa on the retromolar pads.

Research Results

I. About comparisons of each region in the impression molds taken by Provider C.A. and Patient C.A. under the author's supervision

1. Impression surfaces in Patient C.A. revealed that the impression body of mucosal surface was found thinner than in Provider C.A. because the tray was seen through more clearly (**Fig.7**).

2. In the superior portion of the retromolar pads, it was observed that the tongue side wall and the buccal mucosa were conditioned to close approximately toward the lingual inclination on the pads in case of Patient C.A. But in case of Provider C.A., this inclination was not confirmed (**Fig.8**).

3. In the regions posterior to the buccal frenum, where the polished surfaces of denture were corresponding finally, Patient C.A. exhibited slightly more concave shape than Provider C.A., demonstrating the narrowing down shapes toward the lingual side accordingly as in the posterior direction (**Fig.9**). And also in Patient C.A., more clearly defined slits were indented on the anterior margin of the retromolar pads than in Provider C.A. (**Fig.9** arrowed).

4. In the buccal shelves, in case of Provider C.A., the margins from the anterior retromolar pads exhibited expanding externally as they went toward the anterior direction and taking impression of wider buccal shelves. On the contrary, in Patient C.A., the buccal shelves presented a narrower width than in Provider C.A. (**Fig.10**).

5. As for the retromolar pad areas, Provider C.A. exhibited longer oval shapes in the longitudinal direction of the pads,

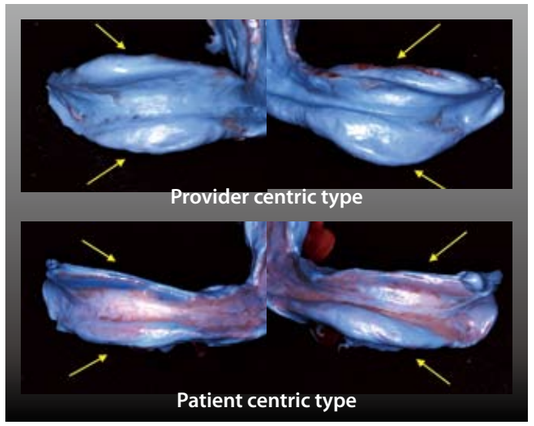

Fig.10 Different impression molds of lingual and buccal flanges.

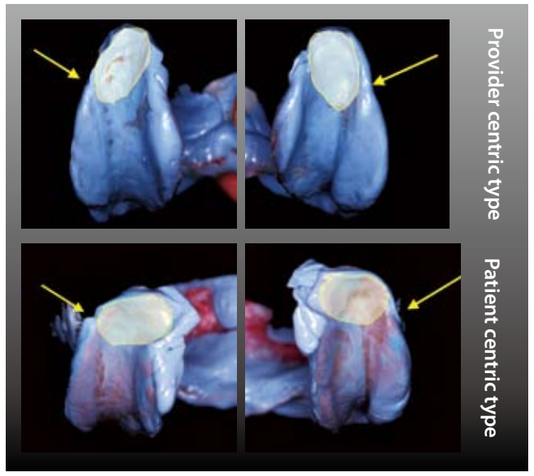

Fig.11 Different impression molds of the retromolar pads.

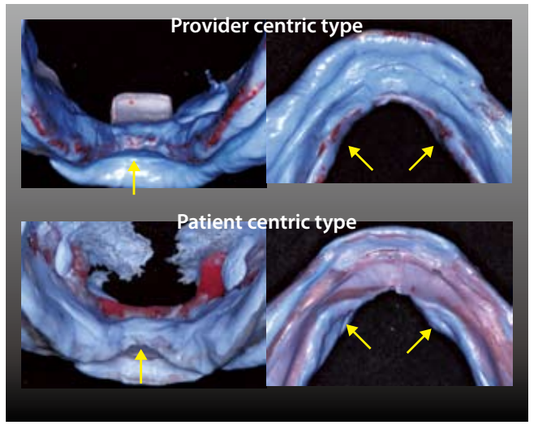

Fig.14 Different impression molds of the tongue frenum and different thickness and length of the sublingual fold flanges.

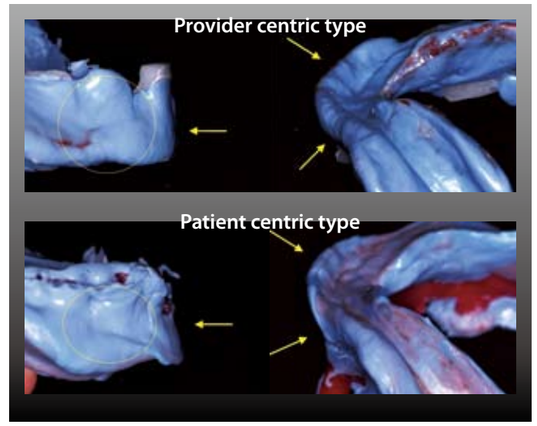

Fig.15 Different impression molds of the buccal frenum and different thickness and length of the labial flanges. Presence and absence of convexity in the lower anterior cervical region.

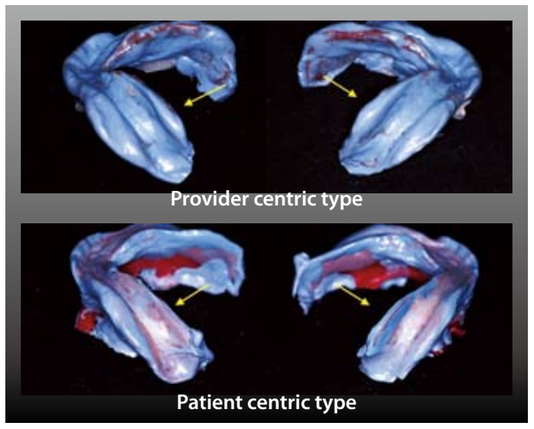

Fig.12 Different length of extension passing over the mylohyoid muscle line of the lingual flange.

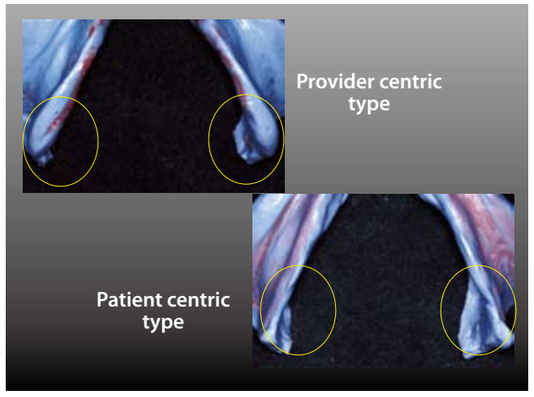

Fig.13 Different impression molds of the tongue root region.

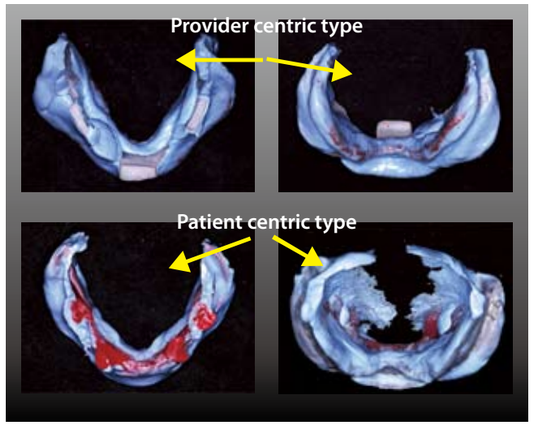

Fig.16 Presence and absence of impression molds of the tongue space.

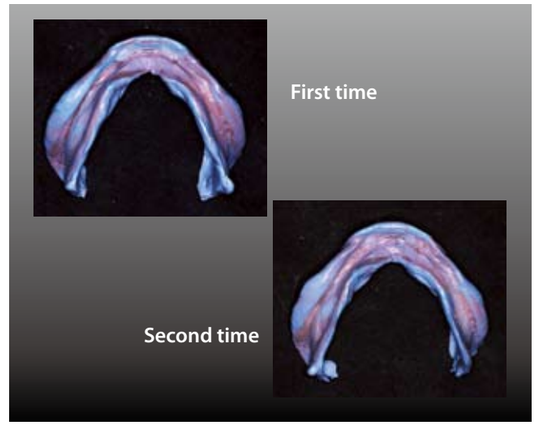

Fig.17 Comparison of impression molds of a patient centric type impression performed twice on an identical patient.

being withdrawn in the superior direction. But in Patient C.A., they exhibited longer oval shapes in the transversal direction, being withdrawn toward the lingual side (**Fig.11**).

6. The lingual flanges taken through Provider C.A. recorded the impressions of the mylohyoid muscles extending toward the lingual side, but in Patient C.A. there were no similar impressions. (**Fig.10**) And the length of the flange was extended fairly long passing over the mylohyoid line in Provider C.A., but in Patient C.A. that length was shorter than Provider C.A. (**Fig.12**).

7. In the impression of Patient C.A., the indentation corresponding to the tongue root was more clearly defined than that of Provider C.A. These indentation records represented the tongue side walls that would force down where the lingual denture polished surface was corresponding (**Fig.13**).

8. The margin of the sublingual fold exhibited thicker and longer impression molds in Patient C.A. than in Provider C.A. And the indentations in the lingual frenum impression showed shallow and flat in Provider C.A., and in Patient C.A. it showed deep and narrow (**Fig.14**).

9. As for the impression of buccal frenum, Patient C.A. exhibited a deeply slit frenum in the direction toward the posterior region (**Fig.15** right).

10. As for the length and thickness of the lingual flange, Provider C.A. showed longer and thicker ones (**Fig.15** right). And Patient C.A. showed concavity more largely in comparison with Provider C.A. in the areas where the denture polished surface corresponded equivalently to the anterior teeth cervical region and modiolus area (**Fig.15** left).

11. In view of the impression mold morphology from the occlusal surface or from the posterior region, the tongue shape was not emerging clearly in case of Provider C.A., but in Patient C.A. the shape of tongue space, its size and status were sufficiently emerged (**Fig.16**).

II. When Patient C.A. was performed twice by the identical patient under the author's supervision, there were no significant differences in shapes (Fig.17).

Discussion

I. Comparison of each impression shape taken under the protocol of Provider C.A. and Patient C.A. by the author, who was of background of 12 years after graduation from a school of dentistry and with a five-year experience of researcher at a department of prosthetics of removable denture of a dental university.

Comparison of impression molds taken by the procedures Provider C.A. and Patient C.A. indicated that their contours

DIFFERENT IMPRESSION SITES

	Provider centric type	Patient centric type
Contact of buccal mucosa and tongue side wall	Absence	Presence
Buccal shelf	Wide	Narrow
Someya's sinew string	Not clear	Clear
Buccal, lingual, labial polished surface	Not clear while in function	Clear while in function
Retromolar pad	Vertically oval	Horizontally oval
Mylohyoid muscle region	Long	Short
Sublingual fold	Short and thin	Long and thick
Tongue space shape	Not clear	Clear

Fig.18 Different impression anatomical sites of a provider centric impression method and a patient centric impression method.

differed gravely even though they were taken from an identical patient by an identical provider. And in view of the impression body of mucosal surface, its thinness of Patient C.A. was noted more finely than in Provider C.A. because the impression tray body was seen through (**Fig.7**). In Provider C.A., the entire inner surface of the tray was reduced for relief except the primary pressure bearing areas such as the buccal shelf and the retromylohyoid muscle eminence (selective pressure impression). In Patient C.A., however, the inner surface was not reduced for relief, and the impression was taken with functional loading. And so differences were noted in the impression body thickness.

1.The superior portion of the retromolar pads in the posterior region

In the superior portion of the retrom olar pads, it was observed in Patient C.A. that the tongue side wall which was extended outwardly from the swallowing movement and the buccal mucosa which was pulled lingually presented to close approximately toward each other on the pads (**Fig.8**).

The buccal mucosa and the tongue side wall are contacted on the superior portion of the retromolar pads so as to function as a closing valve in the posterior region of denture border sealing. If a denture base is properly extended on the superior portion of the pads, any air break-in is not permitted there and the posterior sealing will be completed.

Even in Provider C.A., the retromolar pads are thoroughly covered, and the posterior denture border sealing is already established, and there is a good chance to obtain a suction effect. But there is no confirmation of definite contact between the buccal mucosa and the tongue side wall during this approach of impression taking, and so there is no measurement of success and failure.

2. Polished surface morphology on the buccal side

In the regions posterior to the buccal frenum, where the polished surfaces of denture are corresponding finally, Patient C.A. presents concavity and shape of narrowing down accordingly as it goes to the posterior direction (**Fig.9**). These shapes are impressed mainly from the swallowing movement under the close-mouthed impression taking. The buccal mucosa here works to push food bolus from the occlusal surface into the lingual side, and so these shapes should be provided on the polished surface of the final denture. In Provider C.A., since these shapes are not reproduced in the impression, there has to be provided intentionally later through construction work. Moreover in Patient C.A., clearly defined slits indented on the anterior margin of the retromolar pads may be taken as the sinew string referred in Someya's report (Someya's Sinew String, incidence of 10%)[5]. Contrary to the buccal frenum, which is located equivalently within the oral vestibule but moves largely in accordance with the buccal mucosal movement, this sinew string does not move autonomously in response to the surrounding muscle movements but it is thought to develop passively withdrawn from the buccal mucosal movement. In Provider C.A. where the final impression is simply finished through the functional course of mouth opening and tongue protruding, this sinew string did not develop better than in Patient C.A. where the final impression is completed through the course of those basic five actions and a sequence of functional jaw movements (**Fig.9** arrowed).

3. Buccal shelf

The buccal shelf is an effective region from anatomical views to resist occlusal forces, and, in Provider C.A., a provider is ready for taking an impression of a wider buccal shelf intentionally in consideration of resistance capacity of surrounding tissues regardless of bony external oblique lines. Even if a lower denture base is extended into this area, it would not dislodge by the contraction of muscles following the denture base loading on the buccal shelf of muscle attachment, because there run the muscles underneath attached parallel to the bone. What is more, the area is said to be effective because the mandible has less load bearing area than the maxilla[1]. In Patient C.A., since the impression is taken without preventing any natural movements of not only muscles but also superficial tissues above the muscles including mucosa and fat tissues, the buccal shelf tends to become narrower in width and the bearing area smaller than in Provider C.A. (**Fig.10**).

4. Retromolar pad morphology

Both in Provider C.A. and Patient C.A., the impressions are taken with covering the retromolar pads. And in Provider C.A. where the open-mouthed impression is taken, the shapes are longer ovals in the longitudinal direction after the pads are withdrawn by the pterygomandibular fold that is strained through the mouth opening tension. And in Patient C.A., the pad shapes become longer ovals in the transversal direction as the superficial tissues above the muscles are withdrawn lingually accompanying together with the contraction of the superior pharyngeal constrictor that follows swallowing (**Fig.11**). These shapes will indicate that the retromolar pads taken through the open-mouthed impression would create some space in between the denture base and the retromolar pads when the mouth is closed. Conversely, the denture base inner surface at the retromolar pads that have been taken through the close-mouthed impression will slightly press the posterior region of the retromolar pad that is composed with soft gland tissues or movable tissues while opening the mouth. This will eventually help sealing the posterior denture border.

This kind of shape difference at the opened or closed mouth will indicate similar differences between Provider C.A. and Patient C.A. even in the primary impression taking. In Patient C.A. where impression is taken at the closed mouth with the frameless tray, the pterygomandibular fold will be less strained and flexibly bending at the posterior limit of the retromolar pad by minimizing the impression pressure and by inhibiting excessive force against the retromolar pads, and so the tray outline will become easily identified in this posterior region of the retromolar pads.

5. Lingual Flange

1) Posterior region of the lingual flange

As for the posterior region in Provider C.A., the impression is taken under strained condition of the mylohyoid muscles because the tongue protrusion is retained in the meantime. The site is taken in the impression as extended lingually so that the lingual flange would prevent the denture from lifting while in function although it passes over the mylohyoid line in Provider C.A. When the tongue is in the rest position, or when the mylohyoid muscles are in relaxation, there is a space between the denture periphery and the underlying mucosa. Meanwhile in Patient C.A., although the tongue is allowed to function while taking a functional impression, a great magnitude of tongue movement is not reproduced in the impression, because this impression is finally accomplished with the close-mouthed and swallowing. And as far as the flange length of the site is concerned, in Provider C.A., the border is molded with impression compound so that it can be extended sufficiently over the mylohyoid line to the reflection of the mucous membrane. On the other hand, in Patient C.A., the tongue movement is frequently hindered around this site, and so the custom tray outline is decided so that it can be extended properly to pass over the mylohyoid line until any length is effective (about 2 mm) sufficiently to work as a reciprocation wall against the horizontal movement of mandibular denture. So the impression mold is consequently shaped like this after all (**Fig.12**).

2) Lingual polished surface morphology

In the impression of Patient C.A., the indentation of the tongue root is expressed keeping down the lingual polished surface of the tray (**Fig.13**). In Patient C.A., it is known that the residual ridge around the mylohyoid muscle attachment and the tongue root portion would keep down a denture in order to prevent a large amount of denture displacement and to retain the negative pressure within the base. Furthermore this site is the one with frequent complaints of discomfort swallowing once the final denture is worn. And so it is confirmed that, if this is shaped in concavity likewise as in Patient C.A., discomfort swallowing will be relieved and retrusion of the tongue will be prevented[6].

3) Sublingual fold

In Provider C.A., the margin of the sublingual fold functions to prevent a lower denture to lift while in function, and so the impression is taken with the tongue protruded strongly, and its margin becomes rather shorter and thinner. In Patient C.A.,

the sealing in this region is most easily broken by opening the mouth, and so, in an object to prevent from breaking the seal easily, it is thought necessary to take impression within range of natural actions of impression taking as well as with possible thickness by keeping the contact with the sublingual mucous membrane as broadly as possible[6]. Consequently the tongue is not allowed to move largely while in taking impression, and the margin of the sublingual fold is reserved to some extent of thickness (**Fig.14**).

6. Labial Flange and Labial polished surface morphology

Differences of the labial flange length and thickness are attributed to larger strength and magnitude of eventual functional jaw movements rather than what a provider originally assumed about strength and magnitude. And the impression record showed that the direction of stress on the buccal frenum was toward more posterior region eventually rather than a provider's guidance and it was more strongly recorded rather than the provider's guidance (**Fig.15** right). This can be readily understood from the convexity that corresponds to the anterior teeth cervical area (**Fig.15** left).

As it is well understood that anterior slope of residual alveolar ridge is the best effective pressure bearing area next to the buccal shelf, a textbook suggests that a provider should not mold the borders excessively like intentionally strong withdrawal of the lower lip[2]. So in the procedure Provider C.A., the author was aware of that information and so it made differences of the labial flange length and thickness.

7. Tongue space

In Patient C.A., functional impression movements will end to create the negative pressure molding through the swallowing, and in this occasion the tongue is pushed outward so that the impression record could exhibit sufficient tongue space by the functional jaw movements (**Fig.16**). This space is valid to produce the denture polished surface morphology that has to be reserved for sufficient room for the tongue space.

II. About significant differences in shapes when Patient C.A. was performed twice by the identical patient under the author's supervision

In the procedure Patient C.A., impression shapes will be determined by a patient's functional impression movements. The author tried the procedures twice but there were no significant differences in impression morphology. So it is quite likely that this procedure would be highly reproducible (**Fig.17**).

Impression taking method through Patient C.A. is not performed by a provider but reproduced by a patient's own functional jaw movements under his or her daily life strength and magnitude. And in this case those functional jaw movements would be considered to reproduce continuity of usual behaviors equivalent to daily activities.

Summary

A provider centric impression taking method (Provider C.A.) and a patient centric impression taking method (Patient C.A.) have presented different impression mold morphology of individual oral regions. Objectives that each method is to fulfill have become evident distinctively from shape differences taken through individual method.

- Provider C.A., as advocated by C.O.Boucher and Tanaka, is based on anatomical characteristics of alveolar ridges so as to take as much area of denture base as possible and to increase the occlusal pressure bearing area that is hard to gain in view of importance from the support of lower denture.

It is known that this approach needs the knowledge of anatomy involved, as it has been already introduced into educational courses of many dental schools. Furthermore this approach of impression taking is rather difficult and results in different grades of experience because a provider needs to control the movements following characteristics of surrounding tissues while molding borders. Consequently even if any increasing of bearing area is possible, this impression taking needs skills in higher degree of difficulty, and so it may be a method of lower reproducibility for a less skillful provider. But, for a provider of full skills, in case of difficulty for a patient to control jaw movements, it is advantageous to attain necessary morphology according to a provider's intention.

- Patient C.A. is an impression taking method of achieving the suction effect of lower complete denture against the residual ridge by sealing entirely the periphery of denture base in an object to construct a denture that fills missing space of surrounding oral mucosa without any excess or deficiency.

This approach is of minimum technical differences among providers and highly reproducible because a patient's own functional jaw movements are taken in the impression. Even a less experienced provider can obtain good treatment results including the denture suction effect from this impression method, and the denture suction is very immediate response to sense of fulfillment both for a patient and a provider.

In practice there are patients with stronger or weaker muscles while in functional jaw movements. In completing denture construction corresponding with individual differences, Patient C.A. can be thought effective. On the contrary, in case when a patient cannot control functional jaw movements by oneself or cannot be well communicated, Provider C.A. may be a more effective option.

It is thought necessary for a dental provider to select an appropriate impression taking method under proper diagnosis.

Conclusion

From an observation of the impression mold shapes and characters taken from two different approaches, Provider C.A. and Patient C.A., performed on an identical patient, there were significant differences of each impression site (**Fig.18**). A dental provider should be well informed on morphological differences taken from different procedures as presented here in this study and should be readily responsible to selecting a proper impression taking method.

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