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An issue of shortened dental arch to be considered from changes of soft tissues after unattended tooth loss

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- Part 1
What is biologic adaptation?

● What is adaptation?

In the last issue, the author described about biologic adaptation which refers to the filling of the missing space with the movable tissues of cheek and tongue after long-term of unattended space created in the mouth. But when close observation was made on the site of adaptation, severe ridge resorption is noted. Especially mandibular ridge resorption is fast and only thread-like residual ridge is remaining. (Fig.7) Once this situation is established, the ridge becomes poor enough and the procedure will be greatly difficult, even though implant placement or partial denture insertion is planned.

Now this time, following examples are presented in regard to the relationship of adaptation and ridge resorption as well as its mechanism. Examples are non-prosthetic treatment followed by the lower second molar tooth extraction, insertion of partial denture, and ridge resorption underneath the pontic in flat back type (hygienic type) of lower bridgework.

Fig.7 The residual ridge resorbs extensively to turn out thread like ridge, making prosthetic treatment difficult.

● Mandibular ridge changes after adaptation

It is interestingly noted on the mandibular posterior missing space after adaptation is valid.

Fig.8 shows an 18-year-old female patient in unattendance after 3 months following extraction of the left lower second molar. And Fig.9 shows a 58-year-old male patient in insertion of partial denture for 10 years immediately after tooth extraction.

The former indicated surprisingly fast speed of resorption in the ridge at the same time of filling with movable tissues after the space was left unattended. On the other hand, when the space was filled with prosthesis, the latter demonstrated favorable conservation of residual ridge.

Fig.8 Age 18, female. After left lower second molar tooth extraction, 3 months past edentulous. The residual ridge at left lower second molar site reduced fast. (arrowed)

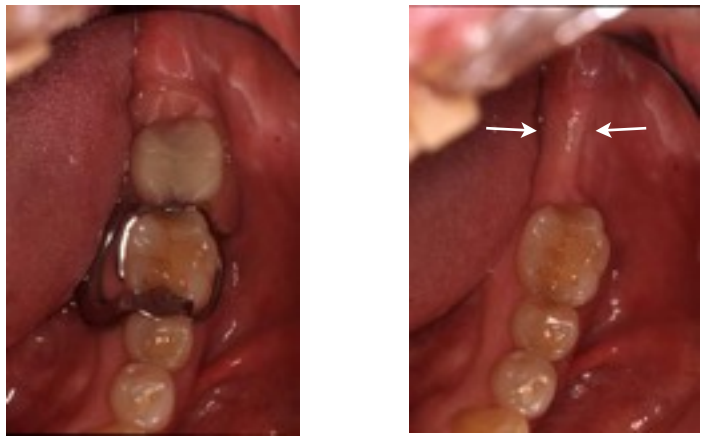

Fig.9 Age 58, male. A partial denture was inserted immediately after extraction, presently in 10 years. Ridge is well maintained. (arrowed)

Generally speaking, resorbed amount of residual ridge after tooth extraction is reportedly determined by ① degree of inflammation at the time of extraction, ② degree of surgical invasion of extraction, and ③ degenerative change from long-term non-prosthetic treatment after extraction. But only with above, this cannot be fully explained about fast resorption speed of the left lower second molar tooth extraction. [3,4]

So the author turned his attention to special features of soft tissues around the mandibular posterior missing space.

When the residual ridge is observed after a short time of tooth extraction (Fig.10), it is noted that there are various lost spaces existing. After tooth extraction, a large lost space is created suddenly. If it continues to exist, food bolus will be deposited every meal eating, resulting in serious trouble to living body.

Living body will respond in repair reaction to this embarrassing, unacceptable space trying to fill with soft tissues quickly. In this occasion, the remaining residual ridge in the mandible is resorbed intentionally to replace with form changing soft tissues to fill in fully. Contrary to conventional reasons for ridge resorption as described previously, it would be better thought to find out causes under investigation like this way of the living body to respond to quicken the resorption.

In Fig.9 where a partial denture is kept wearing, it is a result of holding back the ridge resorption by blocking the invasion of soft tissues and by filling the missing space with prosthesis.

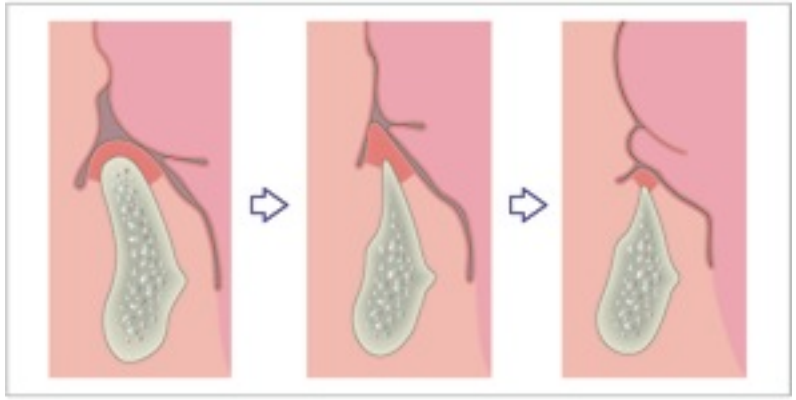

Fig.10 Invasion of buccal mucosa and sublingual into the mandibular posterior missing space trying to fill it fully. (drawings modified from Starshak, 1980) [4]

● Ridge resorption speed in the mandibular posterior region is faster than the maxilla.

At around the buccal side base of retromolar pad, there happens to be noticed a sinew string that works to pull the buccal mucosa within. (Fig. 11) In posterior region to the lower second molar, there is always a space existing even in 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. And this work of sinew string might be one of promoting factors of ridge resorption after unattended missing space. [5] Even if the sinew cannot be visible for its presence in the mouth, 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.

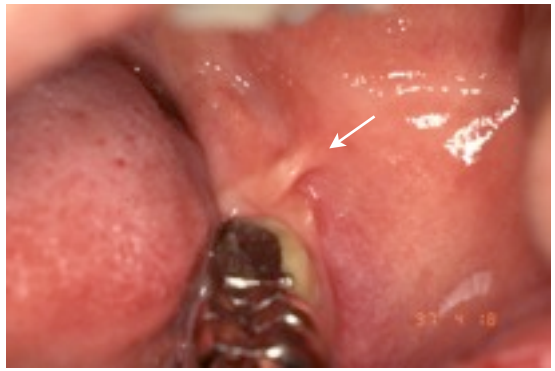

Fig.11 Strong sinew string. It works to pull the buccal mucosa in the lingual side.

And, total amount of muco-buccal fold movement from mouth closing and opening is said to be 2 to 3 times larger in the mandible than the maxilla. And, oral mucosa dynamic behavior around the missing space is far larger in the mandible than the maxilla, too.[6] (Fig.12) It is for these reasons why ridge resorption is faster in repair reaction of buccal mucosa and ridge resorption speed in the mandible than the maxilla.

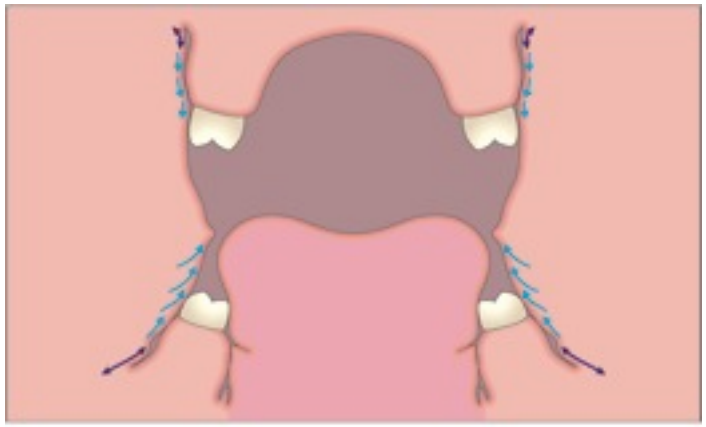

Fig.12 Magnitude of movement of muco-buccal fold from mouth closing to opening. Mandibular movability is said 2~3 times larger than maxilla.

● Does shape of restoration influence on ridge resorption?
- Investigation depending on different types of pontic forms

Is it true that magnitude of ridge resorption does change depending on difference of restoration forms?

The author once assessed what influence of the pontic forms of mandibular posterior bridgework inflicted on residual ridge resorption over time process of years. (Fig.13, 14) [7]

Fig.13 Significant ridge resorption underneath a flat back type pontic.

Summary of Research

4 kinds of pontics, ridge lap type, saddle type, flat back type, and bilge type, were assessed in the following of distance measurements as shown a~d on 189 subjects with insertion of mandibular posterior intermediate bridge restoration.

Number of subjects and measurement sites as per different pontic types

	Number	⑤⑥⑦	④⑤⑥	④⑤⑥⑦	⑤⑥⑦⑧	Others
Ridge lap	55	37	6	3	4	5
Saddle	52	28	6	4	3	11
Flat back	61	37	3	4	4	13
Bilge	21	15	2	1	1	2
Total	189	117	17	12	12	31

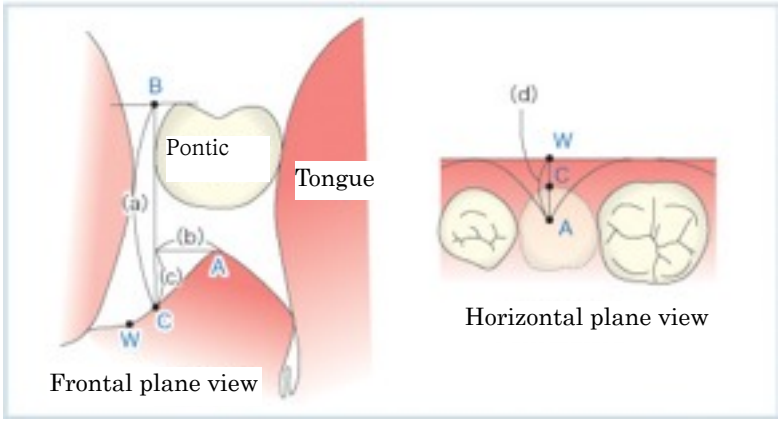

Fig.14 Pontic (Flat back type)

A: Point of most drawn buccal alveolar mucosa into alveolar ridge.
B: Point of buccal side of pontic.
C: Point of contact of alveolar mucosa with vertical line down from point of buccal side of pontic (B).
W: Point of cross at right angles of alveolar mucosa border line of both side abutments and horizontal line from A.

Table 1 Mean value of measurement result (mm)

	Distance a	Distance b	Distance c	Distance d
Ridge lap	12.97±3.20	3.06±1.55	5.06±2.91	4.13±1.94
Saddle	11.67±3.06	3.29±1.23	4.13±1.91	4.09±1.46
Flat back	10.47±2.41	3.92±1.44	3.45±1.76	4.52±1.93
Bilge	12.01±3.74	2.92±1.66	4.15±2.91	3.86±1.77

Bone resorption volume underneath a flat back type pontic is largest both horizontally and vertically.

Distance a: indicates pontic height.
Distance b: indicates whether or not buccal side of pontic has influence on alveolar ridge resorption. As value is larger, horizontal alveolar resorption is larger.
Distance c: indicates vertical remaining of alveolar ridge viewed from neighboring tooth to the missing space. As value is smaller, vertical alveolar resorption is larger.
Distance d: indicates horizontal remaining of bone resorption view from neighboring tooth to the missing space. As value is larger, horizontal alveolar bone resorption with less influence on buccal side of pontic becomes larger.

At that time, a saddle type pontic was prohibited from concerns with cleaning performance for the posterior bridgework construction, and a flat back type pontic (hygienic type) was on the increase. But it was not yet made clear what influence of the pontic forms difference would be given toward residual ridge after prosthetic insertion.

And, 4 different pontics, namely, ridge lap type, saddle type, flat back type, and bilge type, were assessed of measurement on 189 subjects with insertion of mandibular posterior bridge restoration. Table 1 shows the assessment and research. Measurement results are shown in Table 1.

Mean values of each pontic type were compared in graphic representation as regards horizontal resorption amount (b, d) and vertical resorption amount (c) of ridge underlying pontics. A flat back type ridge resorption amount underlying the pontic showed greater values than any other types.(Fig.15) Resorption over process of years was largest in a flat back type, decreasing accordingly in sequence from a ridge lap type, a saddle type and finally to a bilge type. And also, resorption became larger, as the pontic height was higher and as the underlying space beneath the pontic was larger, and furthermore, as the missing space was more posterior in location in sequence of the second premolar, the first molar and the second molar, and as the number of missing teeth became more multiple. (Fig.16)

Fig.15 Mean values of distance b, c, and d.

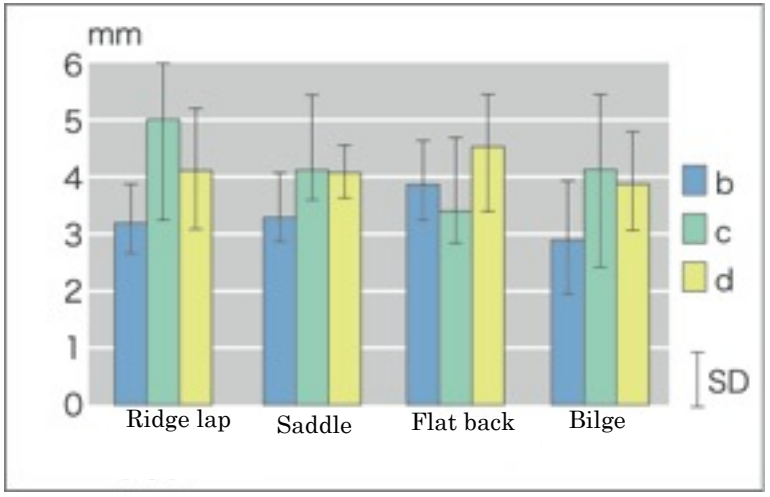

Fig.16 As the missing site comes to be located more posteriorly, alveolar bone resorption comes larger.

When biologic adaptation as described previously is taken account in this case of a flat back type pontic, movable tissues for reaching to fill the underlying space below the pontic base was too much excessive in motion to cause pealing off the attached gingiva that is located on the external oblique line from the alveolar bone , and attached gingiva would move toward the lingual side. as a result bone resorption might have been made secondarily afterward. (Fig.17-1)

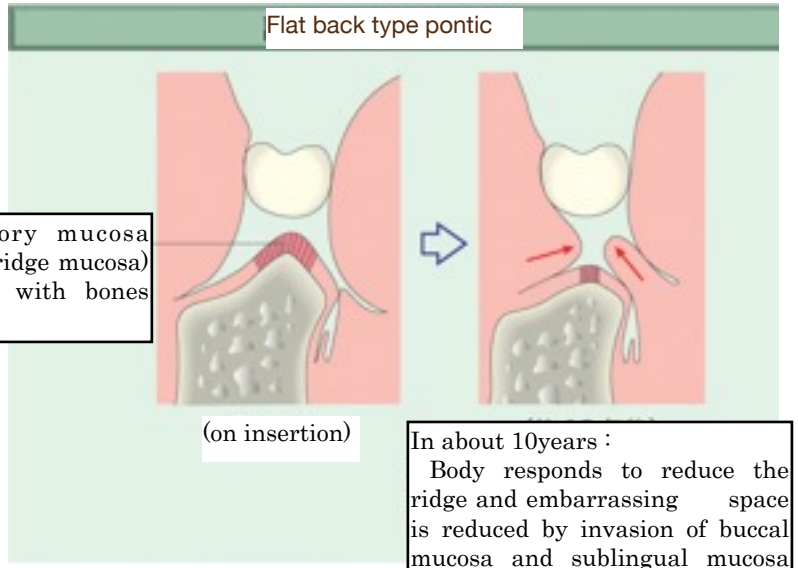

Fig.17-1

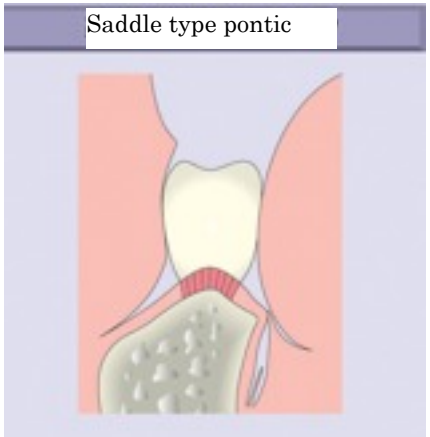

Fig.17-2 No embarrassing space is present to block invasion of movable tissues and to prevent ridge resorption.

On the other hand, in case of a saddle type pontic, pontic buccal side base border and lingual base border will inhibit the movement range of buccal alveolar mucosa and sublingual mucosa, and so it is assumed that alveolar ridge resorption might have been minimum in time process of years. (Fig.17-2)

As described above, if the alveolar ridge is gravely resorbed underneath of a flat back type pontic, then, when a distal extended space is created after posterior tooth loss, not only the denture bearing surface area becomes narrow, but also implant or transplant insertion bed becomes poor and inappropriate.

In this study, it is suggested that there might be some involvement of pontic form difference as a promoting factor of ridge resorption. And if ridge resorption magnitude is variable to pontic forms, it is also suggested that pontic forms should be selected appropriately for prosthetic purposes based on form difference with minimum induction of ridge resorption over time process of years. In reference to this opportunity, a flat back type was recommended in 1960's when the environment was completely incomparable to current technique of casting and standard of oral hygiene.

● Shortened Dental Arch (SDA) viewed from biologic adaptation

It has not yet been so far referred in the literature about significant ridge resorption accompanied with biologic adaptation induced from selection of SDA.

Especially if the missing teeth of both sides lower first and second molars are left unattended for longer period, living body will make ridge resorption at faster speed in order to accommodate smooth process of mastication and swallowing and will fill the useless gap fully with the movable tissues. (Fig.18) However excellent SDA prostheses are inserted, further tooth loss will be in process and another larger scale of prostheses will be needed. Some might say that clinical practice needs will be solved to meet each individual problem as occasion arises. But unfortunately it is not such a simple thing. When thinking about a practitioner's position and responsibility throughout patient's lifetime process, the author cannot encourage selection of SDA prostheses by any means.

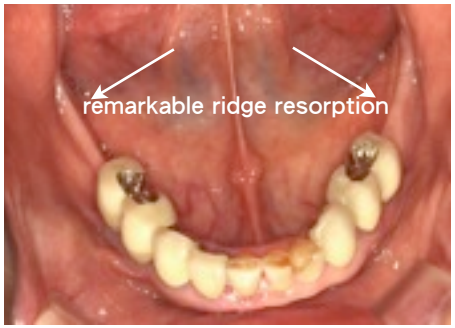

Fig.18 Oral view shows, after missing space was left unattended in the mandibular posterior teeth missing space, alveolar bone reduced to result in a thread like ridge that is inappropriate for restoration.

● Conclusion

Over the two parts of presentation here it has been described about changes of soft tissues after unattended tooth loss. The issue has not been paid much attention so far. It is admitted that somewhat hasty theorization might be found here, but the author hopes our dear readers to take this as challenging.

The author has been long in writing articles mainly on edentulous ridge prosthetics and been developing some feeling for soft tissues rather than other dentists. It may be true to say, "Someone has strange views." But it is grateful if our readers would appreciate it in any way.

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