The Effect of Fixed Implant Prosthodontic Treatment on Mastication Predominance in Patients with Unilateral Posterior Missing Teeth

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Abstract

Background:

The habit of chewing predominantly on one side is called mastication predominance. Excessive mastication predominance may cause stomatognathic dysfunction. Hence, chewing equally on both sides is generally recommended. In our previous study, we found that patients with missing posterior teeth on one side chewed on one side more predominantly than healthy dentate subjects, although there was no significant difference in masticatory efficiency.

Aim:

The purpose was to investigate the effect of prosthodontic treatment for patients with unilateral missing posterior teeth in terms of mastication predominance, and to examine the differences in the effects of treatment with removable partial dentures compared with dental implants.

Materials and Methods:

The sample consisted of 86 patients with unilateral posterior missing teeth who received prosthodontic treatments: removable partial denture (RPD group) or fixed implant prosthesis (IMP group). EMG activities were recorded from the bilateral masseter muscles while subjects were asked to chew chewing gum freely. The assessment of mastication predominance was conducted before and after prosthodontics treatments. The chewing side (right or left) was judged by the level of root mean square EMG amplitude. The mastication predominance was then objectively assessed by mastication predominant index (MPI): the proportion in the number of the difference between the right and left side strokes against the number of total strokes. After cluster evaluation of 70 healthy dentate patients, 40% of MPI was applied to out cut off value. Based on the criteria, MPI before and after treatment was evaluated.

Results:

There was a significant difference in the MPI before and after prosthodontic treatments for both groups. (P<0.05)
When judging, MPI over 40% turned into under 40% by prosthodontic treatment as significant improvement in mastication predominance was observed in the IMP group (P<0.05), especially in the free-end missing unilateral posterior region (P<0.05).

Conclusion:

Masticatory predominance was improved by prosthodontics treatments for patients with missing teeth in the unilateral posterior region. Especially in the implant prosthesis group, significant improvement of masticatory predominance was observed compared to the removable partial denture group for the patients of free-end missing unilateral posterior region.

Analysis of EMG activity

EMG signals were converted to the root mean square (RMS) values

The number of right- and left-side strokes was counted from the EMG data of chewing test food

Assessment of mastication predominance

Mastication Predominance Score (MPS) and Mastication Predominance Index (MPI) was calculated by the following formula

Mastication Predominance Index (MPI) ($0 \leq \text{MPI} \leq 100$)

$$= \left| \frac{\text{Number of right side strokes} - \text{Number of left side strokes}}{\text{Number of right side strokes} + \text{Number of left side strokes}} \right| \times 100 \quad (\%)$$

Results

Criteria for evaluating mastication predominance

Subjects: Healthy dentate (n=70)

Scatter diagram of MPI

Cluster analysis

MPI<0~39% : the no existence of mastication predominance (NMP)

MPI≥40~100% : the existence of mastication predominance (EMP)

Change of MPI by the prosthodontic treatment

Box plot of MPI

There were significant differences in the MPI between before and after Prosthodontics treatment for both groups.

Changes in MPI status through the prosthodontic treatment

Background and Aim

Mastication predominance

Habits/ behavior chewing on one side (left or right) predominantly

Excessive mastication predominance

Harmful on stomatognathic system

Wilding et al., 1992, Bates et al., 1975

tooth attrition

Temporomandibular joint disease

tooth fracture

Our previous studies

Objective Assessment of actual chewing side by measurement of bilateral masseter muscle electromyography.

Yamasaki et al., 2015

Objective assessment of mastication predominance in healthy dentate subjects and patients with unilateral posterior missing teeth.

Yamasaki et al., 2016

The individuals with missing teeth in the unilateral posterior region exhibited:

- tendency of chewing in the contralateral to the missing teeth side
- more aware of mastication predominance than healthy dentate individuals

Purpose

- To investigate the effect of prosthodontic treatment for patients with unilateral missing posterior teeth in terms of mastication predominance.
- To examine the differences in the effect of treatment with removable partial dentures and implant supported fixed prosthesis.

Methods and Materials

subjects	86 patients with missing teeth in the unilateral posterior region 22men and 64 women,Mean age 61.2 (47-75) years old	
	The implant prosthesis group (IP group) n=45	The removable partial denture group (RPD group) n=41
Inclusion criteria	<ul style="list-style-type: none">Over 20 years oldNatural teeth or proper fixed prosthesis in the remaining teeth region	
Exclusion criteria	<ul style="list-style-type: none">Wearing teeth-supported or implant-supported overdenturesExisting systemic and/or dental diseases that influence on masticationDifficulty cooperation in the study, such as dementia	

Recording of EMG activity

EMG activities record from the bilateral masseter muscles while subjects chewed test foods freely
Test foods: one stick of chewing gum

Time of measurement: before prosthesis treatment and prosthesis treatment after 1 month later

Portable EMG recording unit
(ProComp Infiniti Thought Technology)

Bipolar electrodes were set on the masseter muscle in parallel to muscle fibers.

Chewing gum: 18x18x4mm FREE ZONE

Conclusions

- Masticatory laterality was improved by prosthodontic treatments for patients with missing teeth in the unilateral posterior region.
- Especially in the implant prosthesis group, significant improvement of masticatory predominance was observed compared to the removable partial denture group for the patients of free-end missing unilateral posterior region.

References

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