

# **Comparison of masticatory performances between immediately loaded and conventionally loaded mandibular two-implant overdentures with magnetic attachments**

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## **Abstract**

### **Purpose**

The aim of this study is to compare the masticatory performances between immediately loaded and conventionally loaded mandibular two-implant overdentures with magnetic attachments.

### **Material and Method**

Nineteen participants with edentulous mandibles were randomly assigned to an immediately loaded group or a conventionally loaded group. In the immediately loaded group, a magnetic attachment was applied on the same day as implant surgery, and in the conventionally loaded group, a magnetic attachment was applied 3 months after implant surgery. Both masticatory performances, measured by a color-changeable chewing gum and a gummy jelly, and maximum occlusal force were assessed at baseline and at 1, 3, 6, 12, 24, 36 and 48 months after implant insertion.

### **Result**

At the 6-month evaluation time-point, the immediately loaded group exhibited a significantly higher gummy jelly score than the conventionally loaded group. There were no significant differences in masticatory performance measured by the color-changeable chewing gum between the two groups at any evaluation time-point.

### **Conclusion**

The masticatory performance, measured by a gummy jelly, is improved by 2-IOD of immediately loaded at an earlier time-point than of conventionally loaded.

## Introduction

The McGill consensus suggested that two-implant overdenture(2-IOD) should become the first choice of treatment for the edentulous mandible<sup>1)</sup>. Furthermore, to recover MP, 2-implant overdentures (2-IODs) were introduced as a standard treatment option for edentulous individuals<sup>2)</sup>. However, no reports are available regarding the MP of 2-IODs retained by modified magnet attachments. Moreover, no reports are available regarding comparison of MPs between immediately loaded 2-IODs and conventionally loaded 2-IODs.

## Objective

The aim of this study is to compare the masticatory performances between immediately loaded and conventionally loaded mandibular two-implant overdentures with magnetic attachments.

## Materials and Methods

### 1. Study design

This study was a randomized unblinded parallel-group trial.

### 2. Participants

Participants were recruited by telephone from among patients who had previously visited the Dental Hospital of Tokyo Medical and Dental University. All participants were given oral and written information regarding the study and provided written informed consent. The Ethical Review Committee of the Faculty of Dentistry, Tokyo Medical and Dental University, approved the study protocol. The following inclusion criteria were applied:

1. A completely edentulous mandible and any opposing maxillary occlusion status.
2. Adequate bone volume in the anterior mandible for the placement of two implants with minimum dimensions of 4.0 × 10.0 mm.
3. No requirement for bone augmentation.
4. Commitment to undergo at least 4 months of healing after extraction.
5. Good oral hygiene.

The following exclusion criteria were applied:

1. Uncontrolled systemic disease that could compromise implant surgery.
2. History of chemotherapy or radiography in the head and neck region.
3. Heavy smoker status.

4. A history of taking bisphosphonate.

### 3.Surgical and prosthetic procedure

Each participant received new appropriate mandibular complete dentures (CDs). When the adjustment is finished, computed tomography (CT) scans were obtained using this denture as a radiographic guide. From the obtained CT image, the implant planting position is simulated on a simulation software and produce surgical guides. Two implants (Nobel Speedy Groovy RP 4×10–18 mm, Nobel Biocare, Gothenburg, Sweden) were inserted in the inter-foraminal area of each participant according to the manufacturer's protocol for a flapless surgical procedure by the same experienced implantologist. In the immediately loaded group, magnetic attachments (Magfit, Aichi SteelCo, Aichi, Japan) were applied to the implants on the same day as implant surgery, and in the conventionally loaded group, healing abutments were applied. The conventional group was fitted with magnetic attachment, three months after implantation. After surgery, the participants were instructed to keep wearing their dentures 24h a day for 7 days except for denture cleaning to prevent swelling of the mucous tissue and making it difficult to wear dentures. The equivalent part of the implant on the denture mucosal surface was sufficiently relieved so as not to apply stress to the implant.

### 4.Outcome

MP was evaluated using a color changing gum, gummy jelly, and occlusion force meter. Gum was evaluated for mixing ability, gummy for biting ability, and occlusal force meter for maximum occlusal force. As for each measurement method, the mixing ability was freely chewed 60 times, and the amount of color change was calculated. Then I evaluated how many times the color change was equivalent to the number of mastication. Gum jelly (UHA Mikakuto, Japan) was chewed 30 times, and the bite fragments were evaluated on a 1-10 scale. The maximum occlusal force was measured when the occlusion force meter was occluded as long as possible for several seconds. The evaluation period is preoperative, 1, 2, 3, 6, 12, 24, 36, 48 months after the operation.

### 5.Statistical analysis

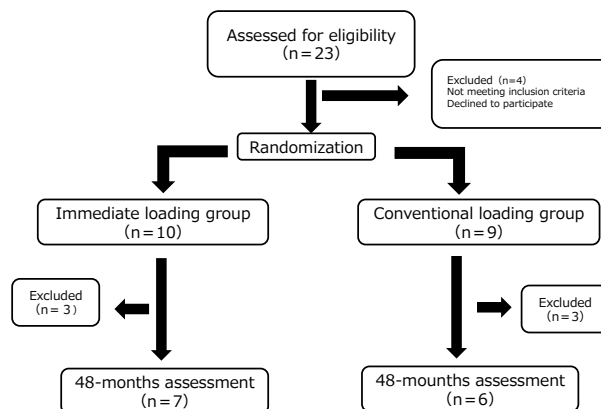
The baseline characteristics of the participants in both groups were compared by using the non-paired t-test and the chi-square test. The Mann-Whitney U test was used to analyze differences in MP and maximum occlusal force between the two groups at baseline and each evaluation time-point after implant insertion. Steel's test was used to compare MP and maximum occlusal force

at baseline with MP and maximum occlusal force at each evaluation time-point after implant insertion within each group. All statistical analyses were performed by using the statistical software JMP ver.13 (SAS Institute, North Carolina). Statistical significance was set at  $P < .05$  for all tests.

## Results

The flow of participants in the study is shown in Figure 1. Nineteen participants with edentulous mandibular arches were recruited into the study. There were a total of 6 dropouts. In the conventional load group, one patient lost the implant within 3 months after the operation, and the remaining five patients were unable to continue the study due to the circumstances of the participants. The final analysis was carried out for a total of 13 people, 7 in the immediate load group and 6 in the normal load group, 4 years after implantation.

**Figure1** The flow of participants



There were no significant differences in MP measured by the color-changeable chewing gum between the two groups at any evaluation time-point (Table 1). At the 6-month evaluation time-point, the immediate group exhibited a significantly higher gummy jelly score than the conventional group (Table 2). There were no significant differences in maximum occlusal force between the two groups at any evaluation time-point (Table 3).

MP measured by the color-changeable chewing gum was significantly higher than baseline at the 36-month evaluation time-point and 48-month evaluation time-point in the immediate group, and there were significantly higher differences at 48-month time-point. From the 3-month evaluation time-point to the 36-month evaluation time-point, MP measured by gummy jelly score was significantly higher than baseline in the immediate group; however, in the conventional group, the gummy jelly score did not differ significantly from baseline at any evaluation time-point (Table 4). Maximum occlusal force was significantly higher at the 12-month evaluation time-point in the

immediate group, compared with base- line, but there were no other significant differences in either group at any time-point (Table 4).

**TABLE1** Masticatory performance scores measured by a color-changeable chewing gum in the two groups from baseline to the 48-month time-point

	Median							
	BaseLine	1 month	3 months	6 months	12 months	24 months	36 months	48 months
Imediaete	60.0	66.8	59.1	75.7	73.7	87.2	104	129
Convetional	53.3	60.2	48.8	59.3	73.5	82.8	110	134
P value	.689	.399	.198	.307	.962	.689	1.00	.721

\*P value <.05.

**TABLE2** Masticatory performance scores measured by a gummy jelly in the two groups from baseline to the 48-month time-point

	Median							
	BaseLine	1 month	3 months	6 months	12 months	24 months	36 months	48 months
Immediate	2	3	4	4.5	4	4.5	5.5	5.5
Conventional	1	1.5	3.5	3	3.5	5	4	4
P value	.784	.433	.504	.034*	.617	.890	.319	.428

\*P value <.05.

**TABLE3** Maximum occlusal force in the two groups from baseline to the 48-month time-point

	Median							
	BaseLine	1 month	3 months	6 months	12 months	24 months	36 months	48 months
Immediate	165	198	185	268	350	303	286	139
Conventional	53.3	60.2	48.8	59.3	73.5	82.8	110	191
P value	.859	.12	.143	.79	.414	.824	.772	.830

\*P value <.05.

**TABLE4** The P values for differences in masticatory performance measured by color-changeable chewing gum and gummy jelly and maximum occlusal force between baseline and each evaluation time-point

	P value						
	1 month	3 months	6 months	12 months	24 months	36 months	48 months
Color-changeable chewing gum							
Imediaete	.737	.993	.192	.267	.098	.004*	.002*
Convetional	.910	.994	.963	.603	.138	.083	.005*
Gummy jelly							
Imediaete	.504	.042*	.002*	.003*	.003*	.031*	.070
Convetional	.914	.266	.331	.205	.159	.407	.253
Maximum occlusal force							
Imediaete	.515	.570	.098	.032*	.098	.087	.098
Convetional	.999	1.00	.383	.174	.065	.182	.128

\*P value <.05.

## Discussions

MP measured by the color-changeable did not differ significantly between two groups at any evaluation time-point. In contrast, MP measured by the gummy jelly increased significantly at the

6-months evaluation time-point. These results suggest that the biting ability improves early after surgery. The reason that no significant difference in the mixing ability between two groups was that the color-change gum was soft to chew easily for CDs wears.

In within-group comparisons, there was no significant difference in MP measured by the color-changeable chewing gum between the immediate load group and the conventional load group before 36-months time-point. The reason for this is that gum texture and increased occlusal contact area due to artificial tooth wear.

There was a significant difference in gummy jelly score in the immediate load group from 3-months time-point to 36-months time-point. This suggests that biting ability has improved compared to preoperatively. On the other hand, the gummy jelly scores in the conventional group did not differ significantly from the baseline score at any time-point after implant loading. This lack of a significant increase may be related to variation in data.

There were no significant differences in maximum occlusal force between the two groups at any time-point, and in within-group comparisons of maximum occlusal force compared to baseline in both groups, only the score at 12-months in the immediate group was significant. And, the maximum occlusal force showed a decreasing trend after one year. The reason was thought to be due to the aging of the participants.

## Conclusions

Within the limitations of the clinical research, the MP measured by a gummy jelly is improved by immediately loaded mandibular 2-IODs with magnet attachments at earlier time-point than of conventional loaded. Therefore, immediate loading of 2-IODs retained by magnet attachments is recommended with regard to MP.

## References

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