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Volume 23, Number 2

The Japanese Society of Magnetic Applications in Dentistry

日本磁気歯科学会

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The Journal of the Japanese Society of Magnetic Applications in Dentistry

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Proceedings of the 13th International Conference on Magnetic Applications in Dentistry

The Japanese Society of Magnetic applications in Dentistry

The 13th International Conference on Magnetic Applications in Dentistry

The 13th International Conference on The Japanese Society of Magnetic Applications in Dentistry organized by JSMAD was held on the Internet as follows;

Meeting Dates:

March 3 to March 21, 2014

Location:

JSMAD web site

http://www.jsmad.jp/international-e.shtml

General Chair:

Prof. Hisashi Koshino, Health Science University of Hokkaido

Conference Secretariat:

Dr. Hideki Aita, Health Science University of Hokkaido

Subjects:

Researches and developments related to dentistry and magnetism such as:

- Magnetic attachments for dentures
- Orthodontic appliances using magnets
- Measurement of jaw movement using magnetic sensors
- Biological effects of magnetic fields
- Dental applications of MRI
- Others

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The 14th International Conference on Magnetic Applications in Dentistry General Information

General Information

The Japanese Society of Magnetic Applications in Dentistry (President: Shinichi Masumi, Kyusyu Dental University) is a scientific association founded in 1991 and is devoted to furthering the application of magnetism in dentistry. The 14th International Conference on Magnetic Applications in Dentistry organized by JSMAD will take place on the Internet as follows.

Meeting Dates:

Monday, March 2 to Friday, March 20, 2015

Location:

JSMAD web site:
http://www.jsmad.jp/international-e.shtml

General Chair:

Prof. Chikahiro Ohkubo, Tsurumi University

Subjects:

Researches and developments related to dentistry and magnetism such as:

- Magnetic attachments for dentures
- Orthodontic appliances using magnets
- Measurement of jaw movement using magnetic sensors
- Biological effects of magnetic fields
- Dental applications of MRI
- Others

Registration Information

Registration:

Send e-mail titled "registration for 14th international conference" with your Name, University or Institution, Postal address, Phone, Fax and E-mail address to conference secretariat.

Registration Fees:

No registration fees. Anyone who is interested in magnetic applications in dentistry can participate in the conference via the Internet.

Publishing Charge for Proceedings:

After the conference, the proceeding will be published. The publishing charge is 8,000 yen per page. (No charge for invited paper.)

Guidelines for Presentation

Deadlines:

Entry: February 2, 2015
Poster submission: February 28, 2015

Entry:

Send Title and Abstract within 200 words with your Registration.

Paper submission:

Please send papers in Microsoft Word format to the conference secretariat by E-mail. All contents should be written in English. No multi-byte character, such as Japanese Kanji, should be contained. A template file can be obtained from the conference web site. Web presentations for the conference will be produced by the secretariat from the paper. The secretariat will not make any correction of the paper even miss-spelling, grammatical errors etc. Alternative format files are acceptable. Please contact to the secretariat for more detailed information.

Discussion:

Discussions will be done using a bulletin board on JSMAD Web Site via the Internet. The authors should check the board frequently during the meeting dates. If questions or comments on your presentation are posted, please answer them as soon as possible.

Notice to Contributors:

Freely-given informed consent from the subjects or patients must be obtained. Waivers must be obtained for photographs showing persons.

Note:

Copyright of all posters published on the conference will be property of the Japanese Society of Magnetic Applications in Dentistry. Copies of the posters will be made and transferred to JSMAD web site for continuous presentation after the meeting dates.
For further information,
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Conference Secretariat

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JJ Mag Dent vol.23 No.2 2014

Contents

A Case Report of Occlusal Reconstruction with Overdentures Using Magnetic Attachments

M. Sone, Y. Kawakami, F. Okutsu, T. Matsukawa, Y. Toyota, R. Negoro, S. Shimokawara,
K. Okamoto and S. Ohkawa

Division of Removable Prosthodontics, Department of Restorative and Biomaterials Sciences, Meikai University School of Dentistry

Abstract

To maintain a harmonious craniofacial system, it is essential to establish an appropriate occlusal vertical dimension (OVD). This case report describes our establishment of an appropriate OVD and occlusal reconstruction with overdentures using magnetic attachments.

For the first therapy, the incompatible prostheses in the marginal portions were removed from its tooth, and #6, 7, and 8 teeth were extracted, followed by setting an immediate denture in the maxilla on the portion of missing teeth. After preprosthetic treatment, the OVD was increased by using an immediate denture and treatment denture, and the patient obtained an adequate occlusal relationship.

As a definitive prosthesis, a maxillary complete overlay denture with magnetic attachments was fabricated.

Introduction

To maintain a harmonious craniofacial system, it is essential to establish an appropriate occlusal vertical dimension (OVD). This case report describes the establishment of an appropriate OVD and occlusal reconstruction with an overdenture using magnetic attachments.

Clinical History

The patient, a 65-year-old male, had a partially edentulous mandible (Eichner B1: missing mandibular second premolar and first molar teeth) with the chief complaint of masticatory dysfunction. All maxillary prostheses had failed, with a marginal discrepancy and caries damage. In addition, OVD analysis led to a diagnosis of intraocclusion (Fig.1).

Fig.1 Intraoral view at the initial examination

In addition, upon periodontal examination, mobile teeth and poor periodontal tissue health were evident (Fig.2). Radiographic examination showed alveolar bone resorption (Fig.3). Finally, we made the treatment decision to fabricate a maxillary overlay complete denture with magnetic attachments, which the patient found acceptable.

BOP			○			○	○	○		○	○			○		
Mobility			2			2	2	2		2	2			2		
PCR																
EPP			333			474	448	746		823	433			523		
(mm)			263			336	468	996		433	533			643		
Location	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
EPP			686		333	222	222	333	333	333	223	222				
(mm)			746		223	322	322	333	433	333	322	222				
PCR																
Mobility			1		1	0	1	1	1	1	0	0				
BOP			○		○	○	○	○	○	○	○	○				

Fig.2 Periodontal chart at the initial visit

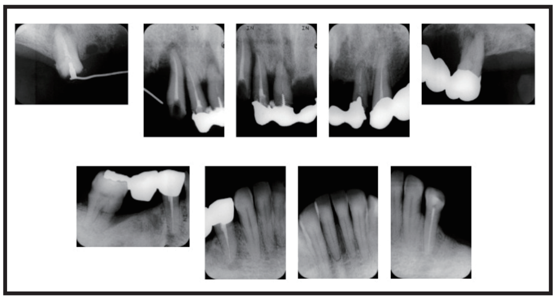


Fig.3 Dental radiographs at the initial visit

Treatment Procedure

At first, the prostheses with the marginal discrepancies were removed, and the #6, 7, and 8 teeth were extracted due to severe caries and periodontitis. Then, an immediate denture in the maxilla was set on a portion of the edentulous area (Fig.4).

Fig.4 Intraoral view with an immediate denture

However, the patient was dissatisfied with the dynamic stability and retention of the immediate denture. Therefore, the magnetic attachments that act as retention elements were applied to the remaining radicular teeth (#3, 10, and 11 teeth). The magnetic attachments used in this case report were GIGAUSS D400® (#10 and 11 teeth) and GIGAUSS D1000® (#3 tooth) (GC, Japan). Keepers of the magnetic attachment were fixed with adhesive resin cement on the abutment teeth (Multilink® Automix, Ivoclar Vivadent, Liechtenstein) (Fig.5). As a result, the patient's complaints of functional dissatisfaction were resolved.

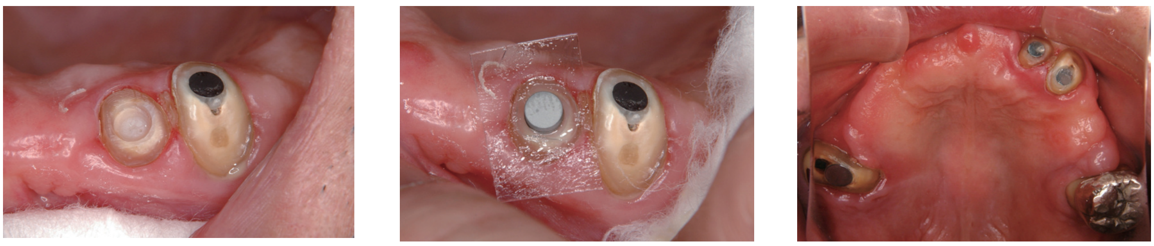


Fig.5 Seating of keepers on the abutment teeth

After the initial preparation (periodontal treatment and extraction of the #14 tooth), the OVD was increased, both by use of the treatment denture and by the built-up restoration using composite resin materials on the teeth, and the patient obtained an optimal occlusal relationship (Fig.6a,b).

a: Intraoral view with treatment denture

b: Composite resin restoration

Fig.6 Bite raising

As a definitive denture, a maxillary complete overlay denture was fabricated with a metal framework made of titanium alloy with magnetic attachments (Fig.7). Fig.8 is an intraoral view of the definitive denture.

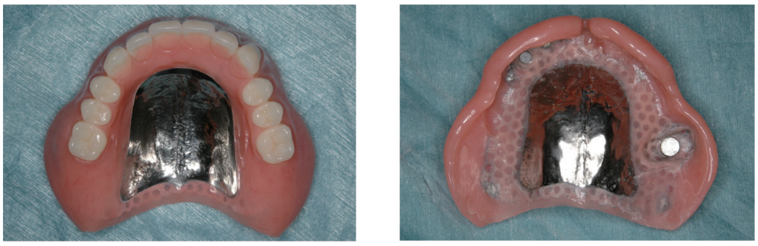


Fig.7 Maxillary overlay complete denture

Fig.8 Intraoral view with definitive denture

Conclusions

The results suggest that the magnetic attachment in the immediate denture could provide the patient with comfortable retention earlier. Therefore, continuous follow-up is necessary with occlusal adjustment and relining of the denture base to prevent any reduction of the OVD. In addition, periodontal management and force control of the remaining dentition should be evaluated during the maintenance program.

Educating clinical dentistry residents about magnetic attachments

S. Nakabayashi

Department of Partial Denture Prosthodontics, Nihon University School of Dentistry

Abstract

When I asked whether clinical dentistry residents know about magnetic attachments, they gave various answers, such as “A device that attaches a denture with a magnet” and “a denture that contains a magnet.”

Although we are educated about magnetic attachments through lectures and hospital training during school days, unfortunately, it remains a fact that neither students nor residents properly understand the features of magnetic attachments.

The magnetic attachment is a useful clinical device. However, incorrect forms and uses cannot assist students and residents in understanding its usefulness; moreover this uneasiness will causes them to choose not to apply a magnetic attachment, a medical treatment method that will grow increasingly important in the future.

Therefore, we have educated clinical dentistry residents to correctly apply magnetic attachments clinically by performing easy training regarding magnetic attachments while introducing them to indications and methods for use, including positive and negative indications for using magnetic attachments.

At this time, we would like to introduce the education that we are actually doing.

Introduction

Although we have taught about magnetic attachments during students’ lectures and hospital practices, the fact remains that many who became clinical dentistry residents do not understand or remember the features of magnetic attachments or use them.

The magnetic attachment device is clinically useful, but residents may not notice its usefulness if they do not understand the correct form and method of magnetic attachment.

Moreover, it is thought that magnetic attachments may not be used as a treatment method in the future.

Thus, since postgraduate clinical training system was introduced into a graduate of dental school 7years ago, we included practice of the magnetic attachment as a part of the education of partial denture.

Then, we introduced educational content and practice.

Objective

Our educational objective is to make teaching understandable so that residents can learn to apply a magnetic attachment correctly with simple practice, using the gnathic tooth model, while having explained the features, indications for use, methods of application, and research results.

Therefore, we introduce improved educational content.

Educational content and practice

1. What is a magnetic attachment?

First, since we want clinical dentistry residents to have a visual of a magnetic attachment, we teach how a magnetic attachment is generally applied using the scheme shown in Fig.1, and we explain the magnet assembly and the keeper that constitute the magnetic attachment (Fig.2).

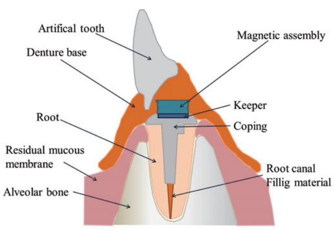


Fig.1 Denture with the magnetic attachment

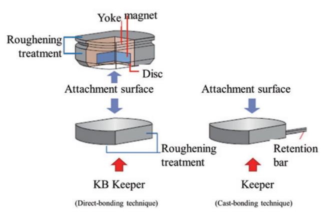


Fig.2 The magnetic attachment

Next, a clinical example explains how the magnetic attachment is used clinically (Fig.3). Although it is a clinically useful apparatus (Fig.4), a magnetic attachment can cause trouble if students cannot understand the features and correct methods for use, including prosthodontics planning.

Therefore, if they apply it clinically without understanding magnetic attachments well, we will advise them that they are unable to demonstrate the usefulness of magnetic attachments.

For that reason, it is necessary to motivate students to learn what they will need to understand about magnetic attachments as dentistry residents in the future.

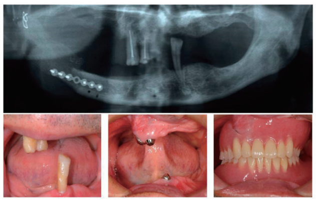


Fig.3 The case of clinical application of a magnetic attachment

An identify is a requirement about whether a clearance is securable.

Fig.4 Notice of an indication of a magnetic attachment !

2. Features of magnetic attachments

The primary two features of a magnetic attachment are that it has semipermanent retentive power, the power of absorption is perpendicularly demonstrated by the maximum (Fig.5).

However, these features may be hard to retain in clinical dentistry residents' minds, even if their textbooks have taught these three features. Students and interns have many questions as to why a magnetic assembly is not installed on the stud-attachment side.

Thus, although a time is already devoted to educating students on these features, it is also important to educate students regarding the rationale for these features so that they will be more memorable.

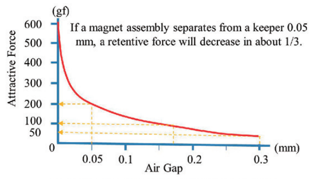
The returning power of absorption, an important feature of a magnetic attachment, requires explanation with an Air Gap curve (Fig.6); the Curie-temperature curve in a paramagnetic body shows the curve to which a magnetic flux density falls with a rise in temperature (Fig.7). Since the ferromagnetic property is lost during thermocasting, we explain the reasons a magnet assembly loses its power of absorption.

As mentioned above, when we expound upon a feature of magnetic attachments that is associated with results of research, a scheme, or a clinical case, students and clinical dentistry residents become convinced.

We win their hearts and advance to the next description.

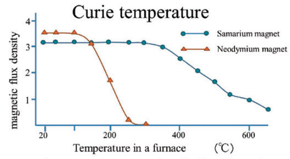
1. Semipermanent power of absorption (retentive force).
2. This shows the maximum power of absorption in the way of a vertical to an attachment surface.

Fig.5 The features of a magnetic attachments



So, the magnet structure may be unable to show sufficient retentive force by fixed operation.

Fig.6 Air Gap curve



since a magneto structure is unfixable to the stud attachment, it is fixed to the dentures side.

Fig.7 Change of the magnetic flux density by a rise in heat

3. Forms and classifications of magnetic attachments

An appropriate design for coping is often explained as having a metal cap whose height is as low as possible; it is also important to install a keeper in a position near the lingual side (Fig.8).

We verify the influence on the tooth root by the difference in the coping height and form as shown in Fig.9. The result of the experiment suggests that the tooth root is least significantly impacted when we make sure the form of the metal cap is as low as possible and that the keeper's position is arranged near the lingual side.

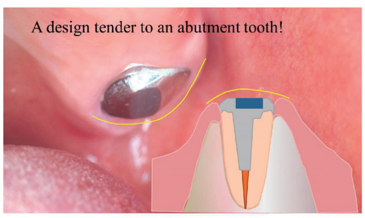
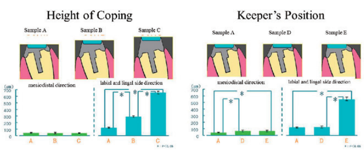


Fig.8 A appropriate design of coping



It is important that height of a coping with keeper as much as possible low, and keeper install in the position from a lingual side

Fig.9 The influence on the abutment tooth by the difference in the coping height and keeper position

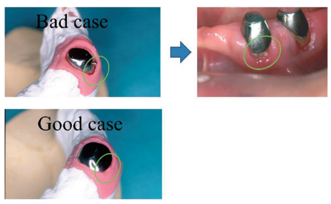


Fig.10 The notes of a form

Moreover, coping needs to be in line with the marginal gingiva, otherwise, the marginal gingiva will cause chronic inflammation, and abutment teeth will have a poor prognosis (Fig.10). With this knowledge, students will notice for the first time that the type of form is important.

4. Relation between magnetic attachments and MRI (magnetic resonance imaging)

In MRI photography, a keeper's artifact of approximately 4–8 cm, according to the SE method (Fig.11), is likely to greatly influence the interpretation of a radiogram.

However, diagnosis of a carcinoma of the oral cavity with MRI imaging is considered to be an important function of dentistry.

Therefore, we devised a magnetic attachment that diminishes the keeper as a cause of artifact possible withdrawal (Figs.12,13).

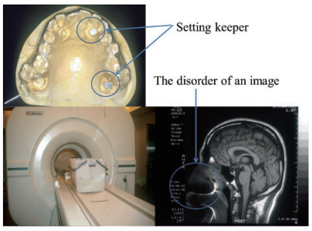


Fig.11

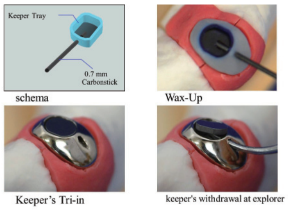


Fig.12 Devise the magnetic attachment which enabled keeper withdrawal

Fig.13 Devise the magnetic attachment which enabled keeper withdrawal

5. Magnetic attachment practices

As a resource of practice, the gnathic tooth model (Fig.14) used for practice is a mandibular model in which the right- and left-dentes canini remain. The magnetic attachment uses D600, which is a GIGAUSS D-type made by GC.

Although the features of the magnetic attachment were explained before training, students will ask questions after training that will deepen their understanding (Figs.15,16).


Fig.14 The gnathic tooth model for training


Fig.15 Form a spillway

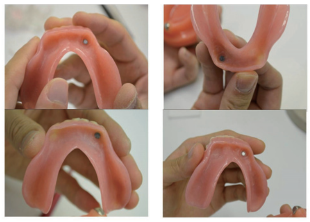


Fig.16 The check of a Luting part

Conclusions

Through the content of study materials, results, and experiencing the difficulty of a magnetic attachment operation through training, we helped dentistry residents to better understand magnetic attachments. We help them consider applying a magnetic attachment clinically to improve patients' QOL.

Therefore, we share with staffs the knowledge acquired by researching the magnetic attachment, and are educating all staffs with it. Although this is an introductory part of the educational content at this time, we think it is important for educators to explain the material using a magnetic attachment, a scheme, a clinical example, research results, and other learning aids.

Evaluation of Testing Procedure Accuracy Described for the Measurement of Magnetic Attachment Attractive Force in ISO 13017

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[2] Division of Biomaterials, Tohoku University Graduate School of Dentistry

Abstract: Dental magnetic attachment was approved by International Standard (ISO 13017). This allowed to guarantee performance and safety of dental magnetic attachments, and to secure reliability as medical equipment by eliminating poor-quality products in the world. The details of attractive force measuring method of magnetic attachments were mentioned in the ISO written standards.

The present study investigated if attractive force of a magnetic attachment can be accurately measured by different measurers based on the attractive force measuring method specified in the written standards to evaluate the need for revising the written standards.

The result showed that each measurer obtained accurate attractive force measurement value of a magnetic attachment, suggesting that the description of the written standards was easy to understand.

Introduction

A dental magnetic attachment International Standard of (ISO 13017) was published in 2012. However the basic methods and techniques for the uniform measurement of magnetic attachments was amended and covered in 2013.

The uniform measurement of magnetic attachments attractive force as applied to an International Standard requires several considerations including, the attractive force measuring method repeatability, measurement accuracy, ease of use and availability. The Japanese Society of Magnetic Applications in Dentistry performed a reevaluation of previous measurement jig and measuring techniques (fixation method) for the measurement of magnetic attachment attractive force. A proposed revision of the written standards was submitted for consideration in April, 2013. A review of the validity, versatility, and accuracy of the document revision contents should be evaluated to confirm attractive force measurement procedures according to the specific written universal standard.

Objective

The present study investigated if the written instructions for attractive force measuring methods specified in the revision of the ISO 13017 written standards can be understood and performed for the first time use. Further, the accuracy and validity of first time use measurements will be examined to determine written standard accuracy and use.

Materials and Methods

1. The proposed revision of the ISO 13017 written standards

Since the proposed revision of the written standards does not contain diagrams, only the documents were distributed. The following are the contents of the proposed revision.

1 The lateral surface is positioned so that the centers of the upper and lower stages installed on the attractive force measuring device are in line.

2 A magnet or attractive surface of a magnet is temporarily bonded to the center of the lower stage using double-faced tape.

3 Cyanoacrylate adhesive is carefully applied on top of the temporarily bonded magnet or magnet assembly.

4 The upper stage is moved downward to press against a temporarily-bonded magnet or magnetic assembly. A joint part is reinforced using autopolymerizing resin if necessary.

5 After a magnet or magnetic assembly is completely bonded to the upper stage, the upper stage was moved upward, and double-faced tape is removed.

6 A magnet or keeper is accurately positioned to the attractive surface of a magnet or magnetic assembly bonded on the upper stage, and attach.

7 Cyanoacrylate adhesive is dropped in the center of the lower stage. The upper stage is moved downward, and the bottom part of a magnet or a keeper is fixed to the lower stage so that the attractive surface is perpendicular to the move axis. The joint part is reinforced using autopolymer resin if necessary.

8 Do not move a magnet or keeper until the adhesive is completely cured. Do not remove the upper and lower stages from the device to maintain the proper position.

9 When the attractive force is extremely smaller than 85% (manufacturer's indicated value), the positional relationship between a magnet and keeper, and magnetic assembly and keeper is adjusted, and remeasurement is performed.

2. Verification method of the contents

1) Measurer

Five measurers (A, B, C, D, and E) with no attractive force measurement experience were selected.

2) Verification method

The proposed revision of the ISO 13017 written standards were distributed to each measurer, and was evaluated according to the following procedure.

Stage 1: Measurement was performed only by reference to the proposed revision of the ISO 13017 written standards.

Stage 2: Questions were asked to experts, and remeasurement was performed.

Stage 3: Remeasurement was performed after observing the measurement by experts.

Feedback was performed after the completion of Stage 1 measurement to elucidate unclear points of the proposed revision.

3. Sample and measurement conditions

1) Sample

Dental magnetic attachment (GIGAUSS C600, GC) was used as a measurement sample. The public value of this sample was 5.88 N.(fig. 1)

2) Measurement conditions

A simplified attractive force measuring device was used for the measurement. (fig. 2) The crosshead speed was 4.4 mm/min. The number of a sample was one, and measurement was performed 10 times. The number of attachment and removal was 5 times for each stage.

Fig. 1 GIGAUSS C600

Fig. 2 Simplified attractive force measuring machine

Results

1. Attractive force measurement value by each measurer

Fig. 3 shows the attractive force measurements of measurers A, B, and C. Consistent attractive force measurements were obtained from Stage 1 to 3. Standard deviation became smaller from Stage 1 to 3.

Fig. 4 shows the attractive force measurements of measurers D and E. The average of measurement results of Stage 1 were lower than the public value of 85%.

Consistent attractive force measurement values were obtained for Stage 2 and 3.

Fig. 5 shows five measurements of Stage 1 by measurers D and E whose measurements showed a high standard deviation. Although the second measurement of the measurer D reached 85% of the public value, the results were higher error was observed after the third measurement. For the measurer E, measurements became consistent after the third measurement by repeating the measurement.

2. The contents of the proposed revision of the written standards that measurers could not understand

The following show the points in the written standards where measurers did not understand after Stage 1.

① The description about a magnet or magnetic assembly, and magnet or keeper is complex.
② Cure time and the amount of adhesive are unclear.
③ The positional adjustment of a magnetic assembly and keeper is unclear.
④ The removal method of a magnetic assembly and keeper is unclear.

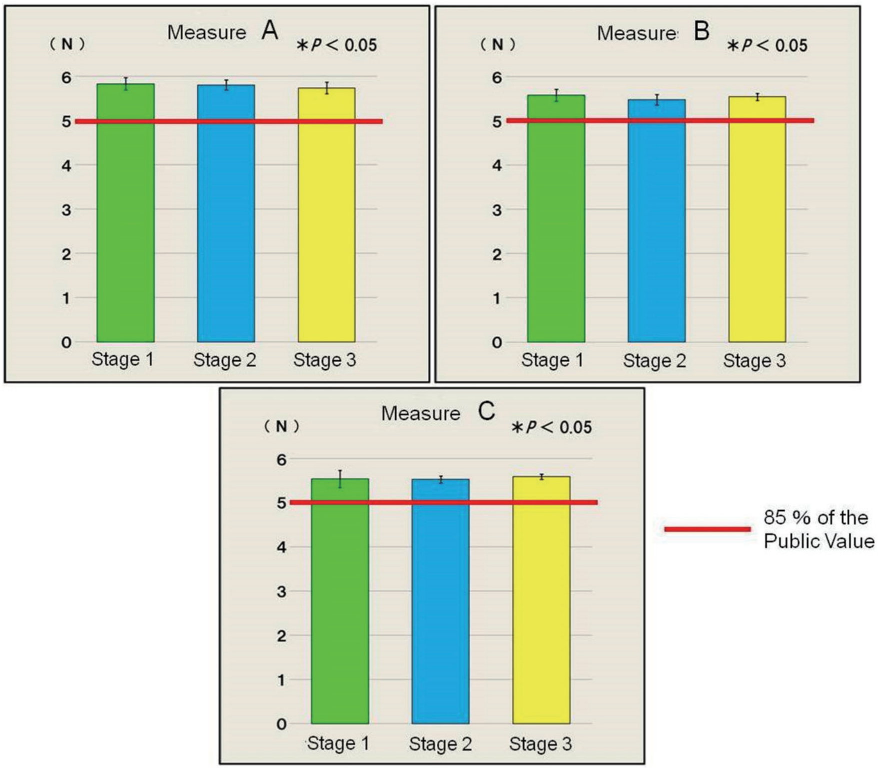

Fig. 3 Attractive force measurements of measurers A, B, C

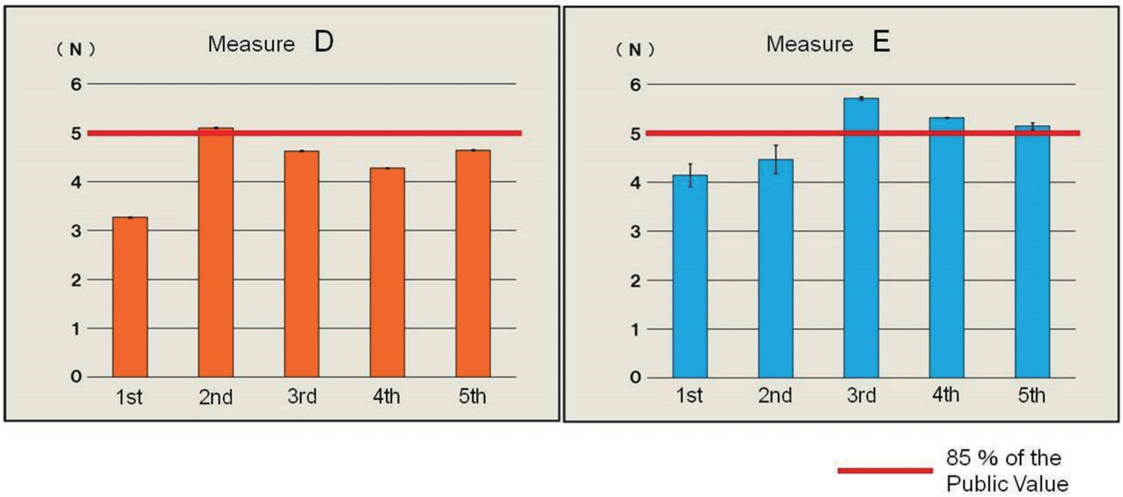

Fig. 4 Attractive force measurements of measurers D, E

Discussion

1. Measurement results

Measurement results of the measurers A, B, and C were consistent, showed small standard deviation, and exceeded 85% of the public value, suggesting that the measurers A, B, and C understood the contents of the proposed revision of the written standards before performing attractive force measurement (Fig. 3).

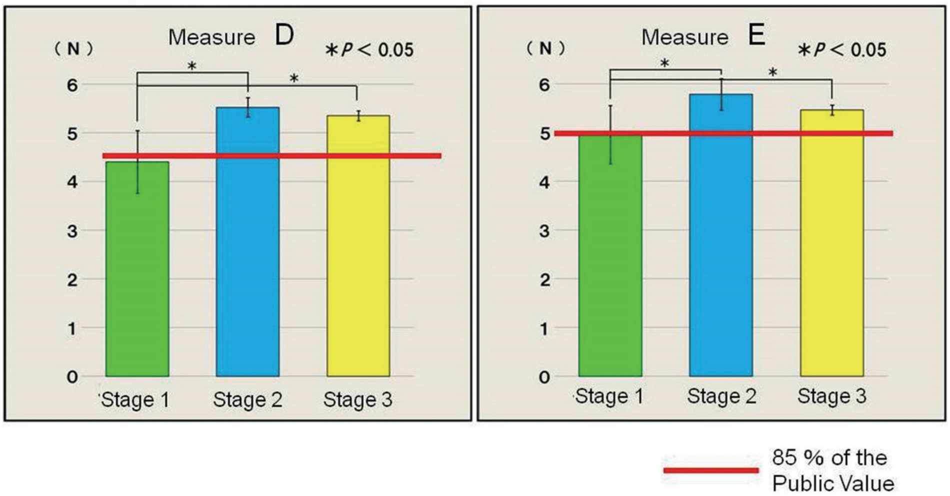

Fig. 5 Five measurements of Stage 1 by measurers D and E

Stage 1 measurements of the measurers D and E showed high standard deviation. This was considered to be due to the fact that measurers did not fully understand the contents of the proposed revision. The more a measurement was repeated, the more consistent measurements became. This was considered to be due to the fact that measurers understood the contents after repeating the procedure.

Although the second measurement of the measurer D reached 85% of the public value, the results were back to low after the third measurement. It was found that the measurer damaged a magnetic assembly and keeper during the second removal, causing unstable results (Figure 4 and 5).

2. The contents of the proposed revision of the written standards

A feedback from measurers after the measurement showed that although the contents of the proposed revision of the written standards that are difficult to understand directly influence on the attractive force measurement value, they were understood by repeating the measurement. To improve the understanding, diagrams should be included in the proposed revision.

Conclusion

The results of the present study showed that a proposed revision of the written standards appears sufficient to standardize the attractive force measurement of a magnetic attachment internationally, suggesting an efficiency with revision of measurement instruction document contents.

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Development of a Simple Measuring Device of the Attractive Force with Magnetic Attachment ー part 2 ー

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Abstract : The most effective attractive force measuring method of a dental magnetic attachment is considered to be a combination of biaxial jig and high sensitivity tension testing machine. The biaxial jig device was developed at the Aichi Gakuin School of Dentistry. The high sensitivity testing machine presently serves as the standard testing device for magnetic attachment ISO measurements. Although this device permits high accuracy measurements, it has a complex structure and high cost.

The Japanese Society of Magnetic Applications in Dentistry has developed an improved testing jig device to improve upon the problems of the biaxial jig testing device. This improved jig design was simplified from a biaxial measurement design to a uniaxial type which has also lowered the overall cost.

As the existing device measuring system utilizes the jig together with a high performance tension testing machine, high versatility and performance are required for both jig and the tension testing machine.

The use of multiple devices required simplification and design improvements for efficiency of measurements and reduction of cost. A simplified attractive force measuring device was thus developed that includes both jig and tension testing machine into a single unit. This paper reviews the measurement accuracy and testing of the new device. The results demonstrate the utility and efficiency of this new attractive force measurement device.

Introduction

The character of retentive force of magnetic attachments used in dentistry requires specialized methods of evaluation to determine the relative quantitative performance different magnetic attachments. Relative retention is a comparative measurement a magnetic attachment to the metallic keeper. Various studies have been conducted on magnetic attachment attractive force measurement techniques at the Department of Removable Prosthodontics, School of Dentistry, Aichi-Gakuin University. An effective dental magnetic attachment attractive force measuring technique has been recently developed. This new technique utilizes a device that combines the a biaxial jig, previously devised at Aichi-Gakuin, and an EZ test high-performance tension testing machine, which presently serves as an approved ISO standard testing device.

Although independently the biaxial jig design itself permits high-accuracy of measurement, its complex structure and high cost precludes ease of use. An improved jig device (hereafter “uniaxial jig”) has been developed by the group, Japanese Society of Magnetic Applications in Dentistry, to improve upon biaxial jig design. The improved jig was simplified from a biaxial to uniaxial design which simplified design and cost factors, increasing versatility.

While previous attractive force measuring systems rely on the compatibility and standardization capacity of the high-performance tension testing machine utilized. The inclusion of a standardized tension testing machine apparatus with a uniaxial jig device was devised to improve upon standardization and compatibility concerns.

Objective

The purpose of the present study was to develop a simplified attractive force measuring device that combines the an axial motion limiting jig device and tension testing machine. The combination device design permits simplified manufacture while maintaining accurate capacity for attractive force measurements, specifically useful for the uniform evaluation of different dental magnetic attachments. The purpose of this study was to evaluate and test the measurement accuracy of such a new attachment measuring device.

Material and method

1. Simplified attractive force measuring machine

The following shows a simplified attractive force measuring machine including a jig and tension testing machine developed in the present study.

a. Device dimensions

The simplified attractive force measuring machine weights 5 kg, and is 120 mm in width, 105 mm in depth, and 370 mm in height. This is less than half the size and weight of a conventional EZ-test tension testing machine (Fig. 1).

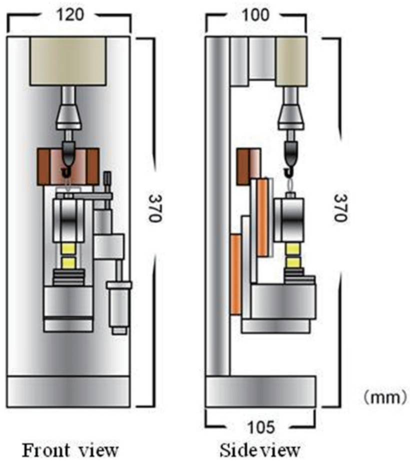


Fig1 Device dimensions

b. Components

The uniaxial jig device was embedded into the measuring machine and fabricated using several pre-manufactured products (Fig. 2).

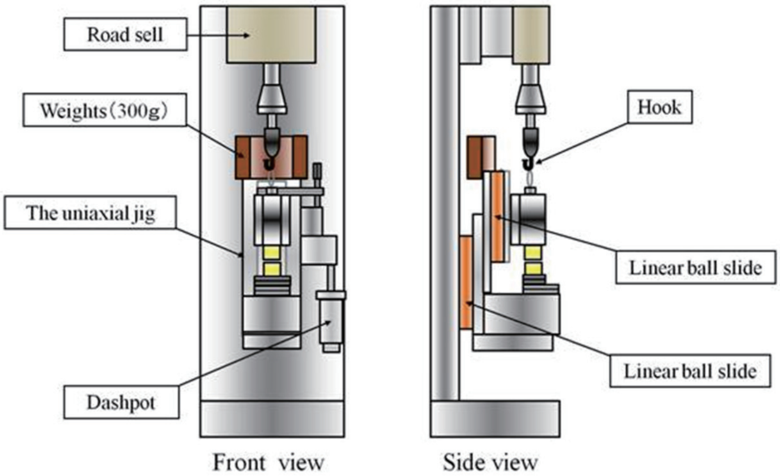


Fig2 Components

The crosshead speed can be set, and a dashpot (KINECHEK, Meiyu) was installed to maintain the speed (Fig. 3). Figure 4 shows the inner structure of a dashpot. When the plunger rod is pushed in, speed is maintained constant by oil pressure, and the rod is returned to its original position by the return action of a stretched spring. The size of the inner oil droplet can be changed by adjusting the bottom scale to change the speed.

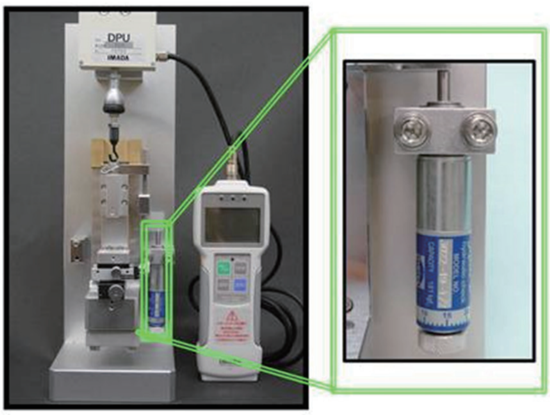


Fig3 Dashpot (KINECHEK,Meiyu)

Fig4 Inner structure of dashpot

Measurement value is displayed on the Digital Force Gauge (Imada) at the maximum load of 50 N and ±0.2% FS measurement accuracy (Fig. 5).

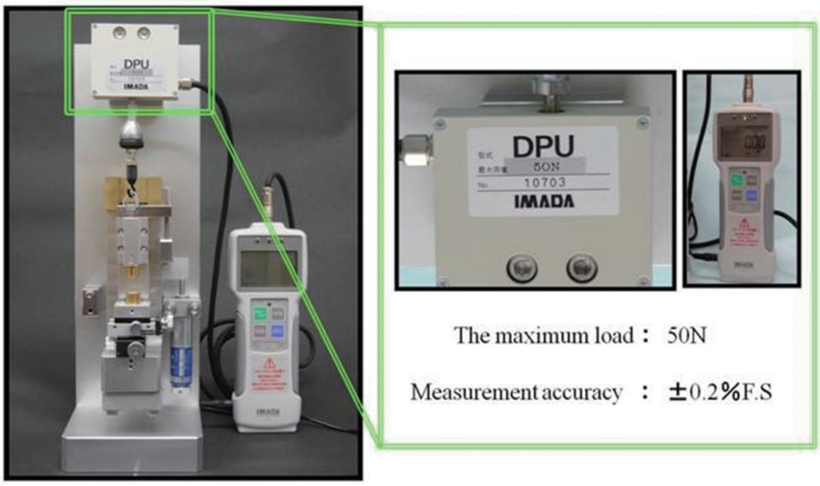


Fig5 The Digital Force Gauge (Imada)

c. Measuring mechanism

The measuring mechanism of a simplified attractive force measuring machine is shown in Figure 6. The bottom right screw is a switch, and the lower jig assembly begins movement downward with its own weight when the stopper is first unlocked. Speed is then controlled by a dashpot preventing acceleration, and measurement is therefore performed at constant speed. A certain minimum weight is required and applied for appropriate descent movement.

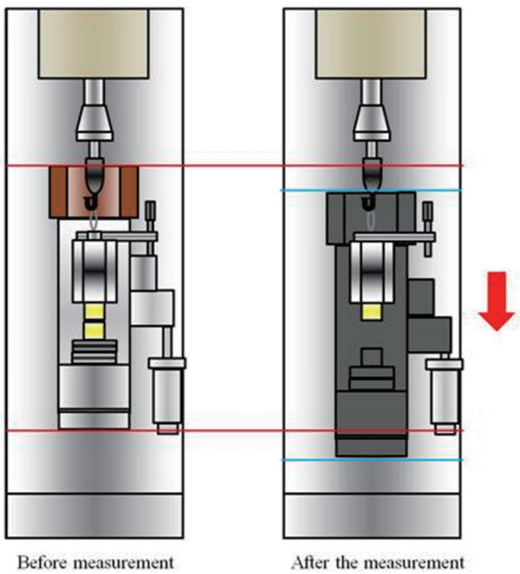


Fig6 Measuring mechanism

d. Crosshead speed setting

The crosshead speed of the machine was set. Based on the previous studies, the crosshead speed is specified at under 5 mm/min in ISO 13017. The time required for the jig to descend 5 mm was measured, and the crosshead speed was calculated. The crosshead speed was 4.4 mm/min at 18 on the scale, and, therefore, the scale was set at 18 in the present study.

2. Attractive force measurement

a. Measurement samples: A magnetic attachment (GIGAUSS C 600, GC) was used as a sample (Fig. 7).

Fig7 A magnetic attachment (GIGAUSS C600,GC)

b. Measurement conditions

Measurement was performed 10 times, and the average was taken as the final measurement. One sample was used to avoid inter-product errors. The crosshead speed was 4.4 mm/min.

c. Measurement result verification of a simplified attractive force measuring machine

3. Testing

The results between the conventional system using biaxial jig and tension testing machine and the new system using uniaxial jig and tension testing machine were compared to evaluate the measurement accuracy (Fig. 8).

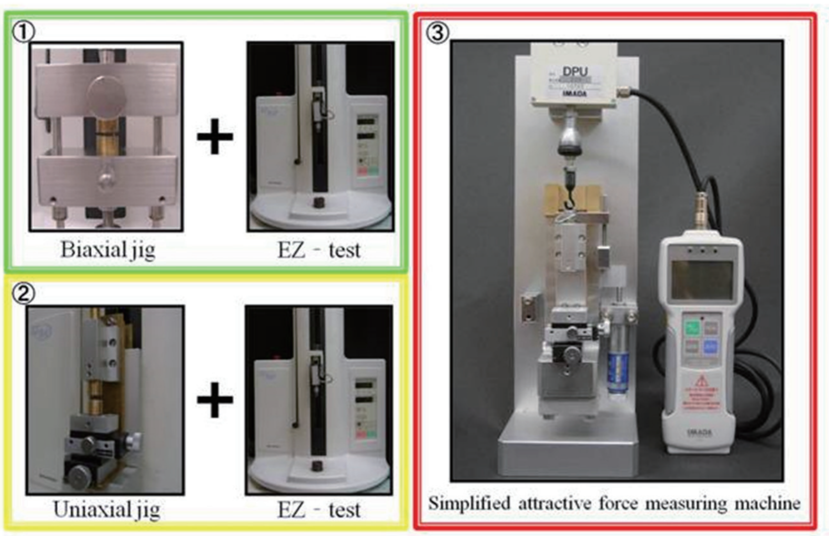


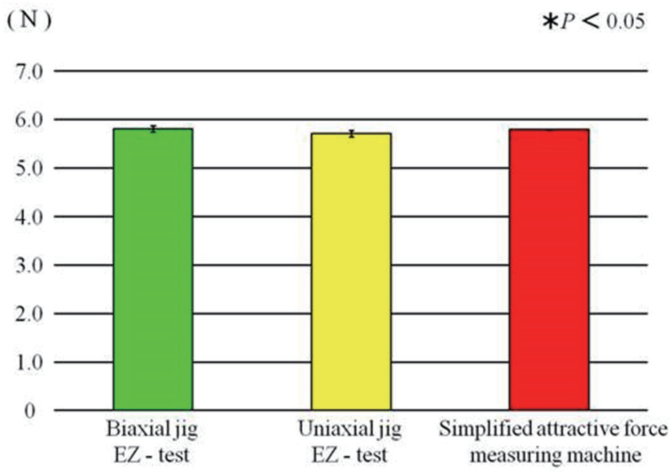
Fig8 Testing

Statistical Analysis was performed. Measurement results were evaluated using one-way analysis of variance and Scheffe Multiple Comparison Method.

Results

Table 1 shows the measurement results. The results were 5.81 N in the measuring method using a biaxial jig, 5.71 N in the method using a uniaxial jig, and 5.79 N in the method using a newly-developed simplified attractive force measuring machine. Statistical analysis demonstrated no significant difference between the three groups.

Table1 Attractive force



Discussions

Prior to the development of the new testing device evaluated, a separate measurement jig and high-performance tension testing machine were necessary for the measurement magnetic attachment attractive forces. The uniform testing of devices in a global environment requires improved standardization and of both measuring devices and measuring frame. A measurement jig was previously accepted for a global standards was developed by the Japanese Society of Magnetic Applications in Dentistry.

The use of the accepted measurement jig was found to be dependent upon testing machine standardizations. A designed inclusion of the tension testing machine components within the measurement jig was designed and developed at the Aichi-Gakuin School of Dentistry. The new attractive force measuring machine that includes both jig and tension testing machine has been shown to provide high accuracy and versatility combined with easy of manufacture and low cost. This measuring design has been determined to be a suitable replacement for the previous conventional measuring system.

The newly-developed measurement machine was produced by combining pre-manufactured components. The prior conventional method utilized a vertical direction pull using a separate high-performance tension testing machine. The newly developed device drops the lower portion components along the guide frame to exert the separation power of a magnet (approximately 1.5 kg) and measures attractive force. The conventional tension-testing machine requires complicated and precise mechanism to pull the machine in an elevated vertical direction using constant speed. The new machine utilizes normal gravity to permit lowering of the machine which is resisted by the attachment device to be measured.

Both measurement techniques use vertical upward and downward movements. The new device manages strong magnetic attachments by adding weight to the top part of the bearing for to increase separation force. The simplified attractive force measuring machine developed in the present study is thus considered to meet all conditions necessary for the magnetic attachment attractive force measurement. The new machine is reduced in size and overall costs compared to conventional tension testing machines. Virtually identical attractive force measurement values can be more easily obtained under any worldwide environment, and thus facilitates inter-laboratory testing.

Conclusion

A simplified attractive force measuring machine including both jig and tension testing machine have been developed. Comparative testing has demonstrated measurement accuracy and reproducibility, suggesting acceptability and consideration as a uniform method and device for attractive force measurement.

The uniformity of access, small size, and availability of components, the new testing device presented as a simplified attractive force measuring device appears to facilitate and enable inter-laboratory testing of attractive force measurements world wide.

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Randomized controlled clinical trial of immediately loaded mandibular 2-impant overdentures retained by magnetic attachments: preliminary report

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Abstract

The null hypothesis of this randomized controlled trial was that there was no difference between immediate loading and conventional loading of implant overdentures with magnetic attachments in terms of the implant survival rate and patient-reported outcome when applying CAD/CAM template-guided flapless surgery.

Nineteen participants with edentulous mandibles enrolled in this randomized controlled clinical trial. Two implants (Speedy Groovy, Nobel Biocare) were inserted. Two magnetic attachments (Magfit, Aichi Steel Corporation, Aichi, Japan) were positioned in the mandibular complete denture on the day of surgery in an immediate group and 3 months after surgery in a conventional group. Subjects were seen for follow-up examinations after 1, 2, 3, 4, 5, and 6 months. The survival of each implant was evaluated clinically and radiographically. Surgical and prosthetic complications were recorded. OHIP-EDENT-J was used for patient-reported outcomes.

During the initial healing period, 2 implants failed in one patient in the conventional group. The cumulative implant survival rates at 6 months were 100% in the immediate group and 88.9% in the conventional group. In this 6-month long preliminary study, the immediate loading of 2-implant mandibular overdentures with magnetic attachments resulted in favorable implant survival and oral health-related quality of life as compared to conventional loading.

Introduction

According to McGill consensus, Mandibular 2-Implant Overdentures (2-IOD) is the first-choice standard of care for edentulous patients.[1)] However, the available data are few and inconclusive regarding the immediate loading of two unsplinted implants retaining a mandibular overdenture with a freestanding connection.[2–7)]

The null hypothesis of this randomized controlled trial was that there was no difference between immediate loading and conventional loading of implant overdentures with magnetic attachments in terms of the implant survival rate and patient-reported outcome when applying CAD/CAM template-guided flapless surgery.

Materials and Methods

Patient Selection

The treatment protocol of this study was approved by the Institutional Review Board of Tokyo Medical and Dental University.

Nineteen patients with edentulous mandibles at the Dental Hospital, Tokyo Medical and Dental University, enrolled in this study.

The exclusion criteria were as follows: insufficient bone volume in the interforaminal area of the mandible, severe systemic diseases, radiotherapy and chemotherapy, and osteoporosis.

Clinical Procedure

1. Pre-surgical Treatment

A new mandibular complete denture was fabricated for each patient (Fig.1a). To prepare radiographic guides, gutta-percha markers were put into the newly fabricated complete dentures. The computer planning followed the design procedure (Procera, Nobel Biocare) (Fig.1b). Surgical guides (NobelGuide, Nobel Biocare) were fabricated for each patient (Fig.1c).

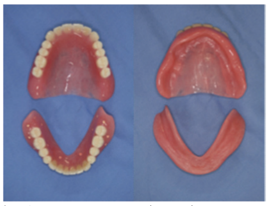
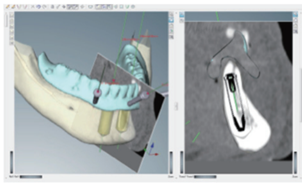


Fig.1a. New complete denture



b. Computer planning with Procera software

c. Surgical guide (NobelGuide)

2. Allocation of the Participants

All of the participants were allocated to an immediate group or a conventional group, based on their age, gender, and the ACP classification system for complete edentulism.

		Immediate group	Conventional group
Age (SD)		69.2 (10.6) 46-81	66.6 (9.1) 59-85
Gender	Male	6	3
	Female	4	6
ACP Classification	Ⅰ	2	2
	Ⅱ	3	2
	Ⅲ	4	3
	Ⅳ	1	2

Table 1 Character of the participants

3. Surgical Treatment

All surgical treatment was performed under intravenous sedation (Propofol). The local anesthesia (Lidocaine hydrochloride 2%) was injected through a guide hole (Fig.2a). Flapless surgery was performed with this surgical guide according to NobelGuide protocol (Fig.2b). Two threaded titanium oxide-surface implants (NobelSpeedy Groovy, Nobel Biocare) (n = 38 implants) were inserted between the lateral incisor and canine positions (Fig.2c,d). The keepers were positioned for each implant (Fig.2e).

Fig.2a.

b.

c.

d.

e.

4. Prosthetic Treatment

Two magnetic attachments (MAGFIT, Aichi Steel Corporation, Aichi, Japan) were positioned for the mandibular complete denture the day of surgery in the immediate group and 3 months after surgery in the conventional group. The patients were instructed not to remove the denture for up to a week after the operation. During this period, the operator cleaned the implants and the denture every other day. For 1–3 weeks after the operation, patients removed the dentures 3 times a day when they brushed the implants. The dentures were worn continuously except during brushing. Six months after the operation, the new implant overdentures were fabricated (Fig.3a–d).

a. b. c. d.

Fig.3 (a) the implant and magnetic attachment; (b) try in of the magnet; (c) trimming the denture for the magnet; (d) magnets picked up into the denture

5. Outcomes

Patients were recalled after 1, 2, 3, 4, 5, and 6 months and 1 year after surgery (Fig.4). The survival of each implant was evaluated clinically and radiographically. Surgical and prosthetic complications were recorded. OHIP-EDENT-J[8] was used for patient-reported outcomes.

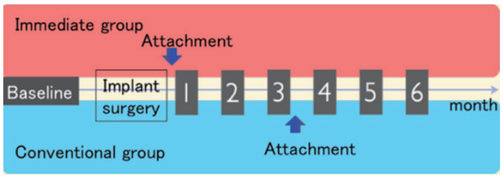


Fig.4 Treatment and evaluation flow

6. Statistical Analysis

A Kaplan-Meier analysis was used to evaluate the implant survival rates. The differences from the baseline were assessed by t-tests every month. The significance level was set at 0.05. All statistical analyses were performed on a personal computer with SPSS ver18.

Results

During the initial healing period (1–2 months), 2 implants failed in one patient from the conventional group. One patient, with two failed implants, dropped out prior to completion of the study. The failed implants were included in the evaluation of cumulative implant survival. The cumulative implant survival rates at 6 months were 100% in the immediate group and 88.9% in the conventional group (Table 2).

From the OHIP-EDNET, significant decrease trends were found at 1 month and 3 months in the immediate group as compared to the conventional group (Fig.6). This result indicates that immediate loading probably improves oral health-related quality of life.

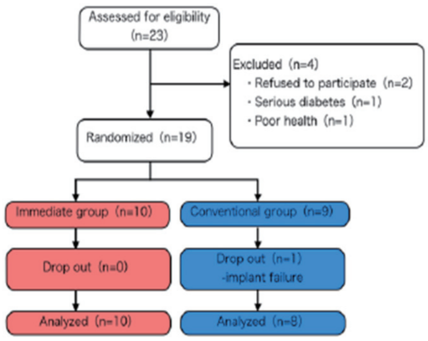


Fig.5 Design of the randomized controlled trial.

		Immediate group	Conventional group
Implant length (mm)	10	0	1
	11.5	2	3
	13	2	5*
	15	14	7
	18	2	2
Insertion torque (Ncm)	45>	20	18*
Cumulative survival rate in 6 months		100% (20/20)	88.9% (16/18)

Table 2 Implant variables

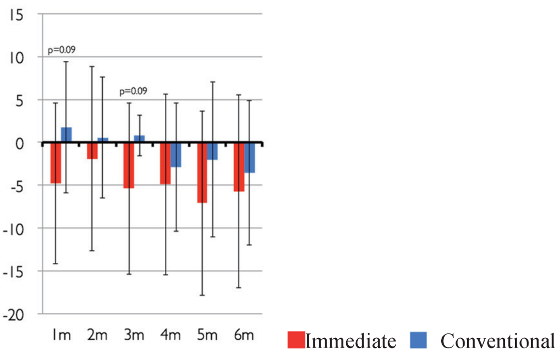


Fig.6 The difference from the baseline in the summary score of OHIP-EDENT

Conclusions

In this 6-month preliminary study, immediate loading of mandibular 2-implant overdentures with magnetic attachments resulted in favorable implant survival and oral health-related quality of life as compared to conventional loading.

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Fixation of magnet assembly using soft lining material and photopolymerization denture base resins

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Abstract

Introduction: Special care should be taken when magnetic attachments are mounted to denture bases using autopolymerized resin. In this study, the retentive force between modified magnetic attachments and denture base resins were evaluated using soft lining material and photopolymerization acrylic resins.

Materials and Methods: Magnetic assemblies with three different undercuts were prepared in this study. Two surface treatments (adhesive resin cement and metal adhesive primer) were applied on the magnetic assemblies. Two types of soft lining materials (the conventional type and a type with added PMMA resin polymer) and two photopolymerization denture base resins were prepared as materials for fixation the magnetic assemblies to the denture base. After the magnetic assembly was attached exclusive of the jig, the tensile strengths were measured using an autography at a crosshead speed of 1.0 mm/min as a retentive force. Obtained data (n=5) were analyzed using a one-way ANOVA, Tukey's multiple comparison, and a t-test (α=0.05).

Results and Discussion: Modified magnetic assemblies showed the higher retentive forces than did conventional ones ($p<0.05$). Surface treatments and fixation materials did not show significant differences ($p>0.05$). All modified magnet assemblies would be fixed in denture bases using soft lining materials and photopolymerization acrylic resins.

Introduction

Magnetic attachments are widely used for retention of removable dentures in prosthetic rehabilitation. In general, a magnet assembly is directly fixed to the denture base using autopolymerized polymethyl methacrylate (PMMA) resin by the brush-on technique after the keeper was set to the abutment tooth or the dental implant. However, special care must be taken when the magnetic assembly is fixed to the denture base using autopolymerized resin because the denture may become impossible to remove from the abutment teeth or implant due to undercutting around the keeper and polymerization shrinkage of the PMMA resin. A new modified magnet assembly with three wing undercuts has been developed that can be mounted to the denture base using a soft lining material or photopolymerization resins (Fig. 1).

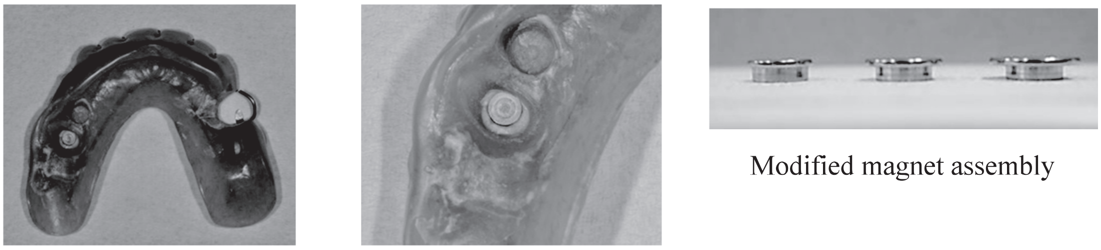

Fig. 1 A modified magnet assembly was mounted to the denture base.

Objective

In this study, the retentive forces between a new modified magnet assembly and the denture base was evaluated using soft lining material and photopolymerization acrylic resin.

Materials and Methods

The magnetic assembly (NEOMAX, diameter: 3.5 mm) was modified by adding three different undercut wings (diameter: 4.5 mm, 4.8 mm, and 5.5 mm) (Fig. 2). A conventional magnetic assembly (Nissin, PHYSIO MAGNET 35; diameter: 3.5 mm; thickness: 0.8 mm; attractive force: approximately 5.5 N) was also prepared as a control. The materials selected for the fixation of magnet assembly included a soft lining material at a standard ratio, a polymer increased to 1.5 times the manufacturer's recommendation (SOFT LINER, GC Co., Ltd.), and two types of photopolymerization denture base resin (TOKUSO LITE REBASE (TO), Tokuyama Dental; and MILD REBARON (RE), LC Co., Ltd.). In addition, a combination resin, in which 40 % PMMA resin was added to 60 % soft lining polymer material, was used in this study. As a surface treatment, a metal primer (ALLOY PRIMER (AP), Kuraray Co., Ltd.) and a bonding material (Super-Bond (SB), Sun Medical Co., Ltd.) were applied on the wing undercuts. Specimens without surface treatment (Non) were also prepared. After surface treatments, magnet assemblies were fixed in the resin housing using a soft lining material, photopolymerization denture base resins, and combination resins (SR) (Fig. 3). The tensile strengths were measured using autography at a crosshead speed of 1.0 mm/min as a retentive force (Fig. 4). Five specimens were fabricated for each condition; a total of 180 specimens were prepared. Obtained data (n=5) were analyzed using a one-way ANOVA, Tukey's multiple comparison, and a t-test (α=0.05).

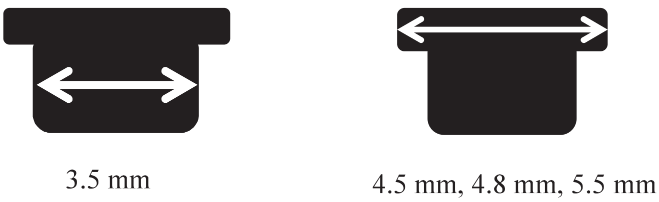

Fig. 2 The magnetic assembly modified by adding three different undercut wings

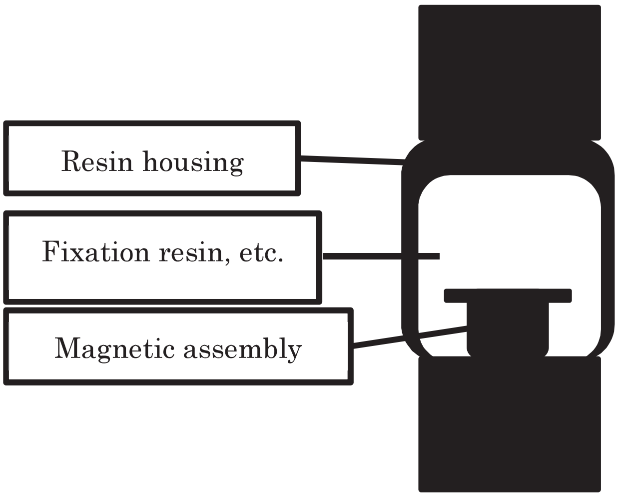

Fig. 3 Fixation of the magnetic assembly

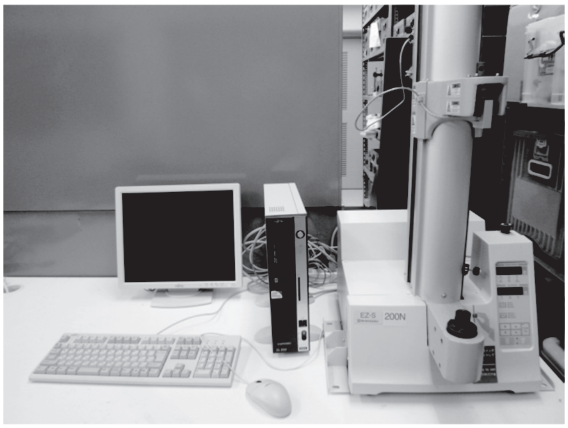

Fig. 4 Autograph used in this study

Results

Fig. 5 shows the retentive forces using a soft lining material in the standard P/L ratio. With surface treatment, SB tended to be a higher retentive force than did AP and Non ($p>0.05$). Three different undercuts showed the similar retentive forces. All modified magnetic assemblies demonstrated higher retentive forces than did the controls ($p< 0.05$).

The use of a soft lining material with 1.5 times the amount of polymer demonstrated 1.2–1.5 times higher retentive forces than did those used the standard P/L ratio ($p< 0.05$) (Fig. 6). The retentive forces of two photopolymerization denture base resins and a combination resin are shown in Fig. 7. TO and RE showed the retentive forces similar to those of the control and the modified magnet assembly. Using the SR, the modified magnet assembly with a 5.5-mm wing undercut demonstrated the highest retentive forces among all of resins tested ($p< 0.05$).

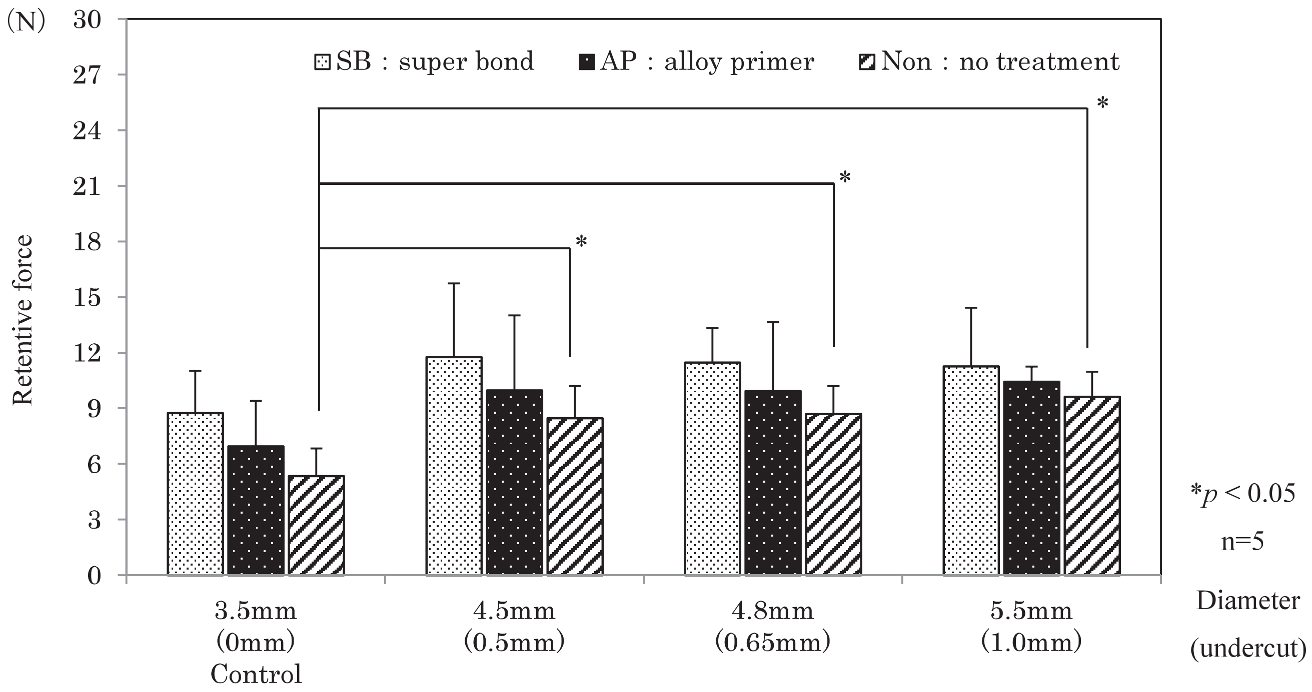

Fig 5. Soft lining material in a standard P/L ratio

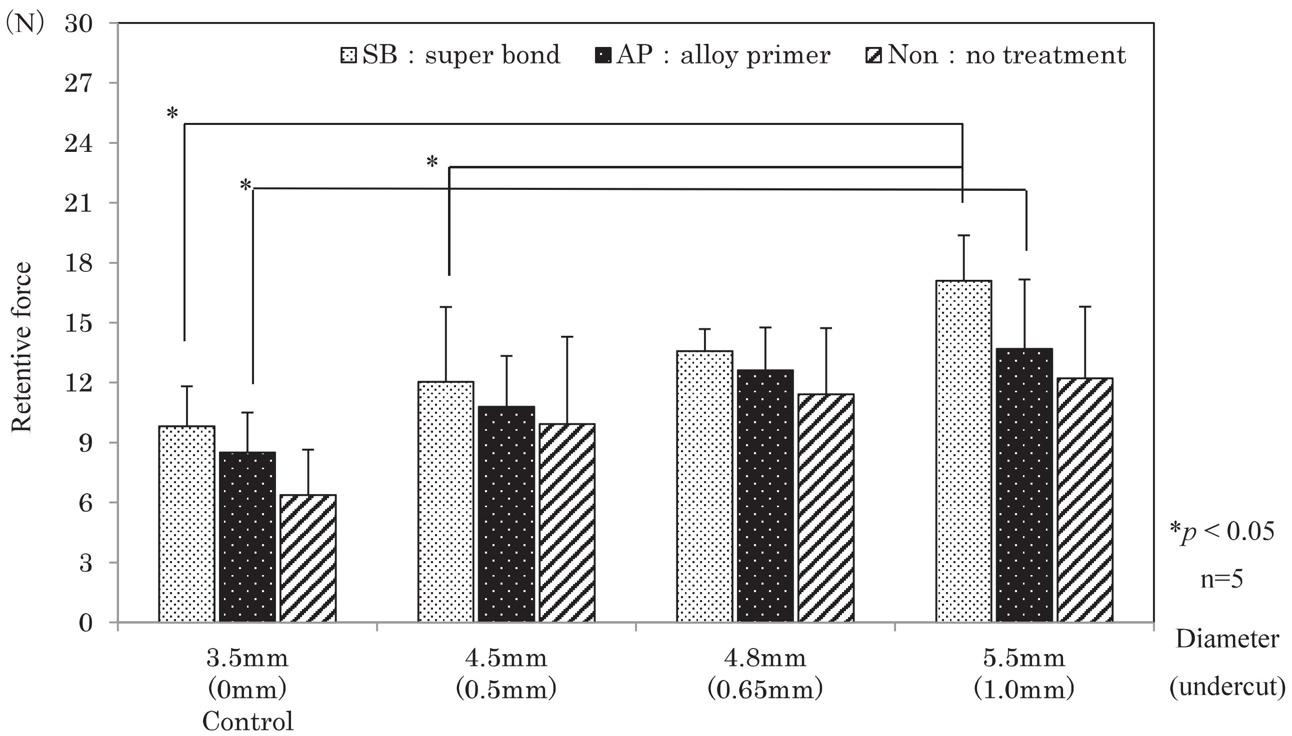

Fig 6. Soft lining material used at a rate of 1.5 times that of the volume of powder

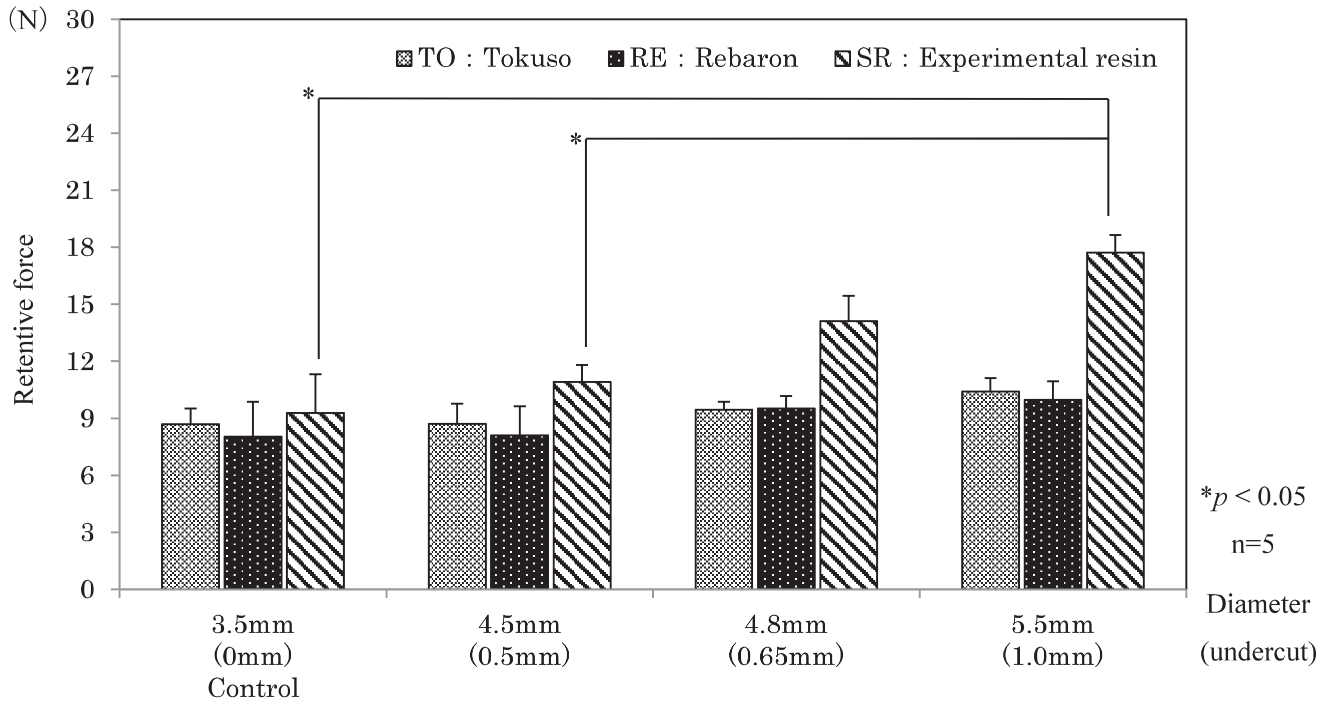

Fig 7. Two photopolymerization denture base resins and an experimental resin (soft lining material hardness : 1.5 times)

Conclusion

The retentive forces of all modified magnetic assemblies showed 8.79 N–17.12 N, and the attractive force of the magnetic attachment was approximately 5.5 N. Therefore, the modified magnetic assemblies would be kept the fixation to a denture base that used a combination resin and photopolymerization acrylic resins.

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