There has been a steady increase in demand for dentures as Japan becomes a geriodontological society. The use of thermoplastic synthetic resins for dental prostheses has drawn wide attention, and is now part of the Japanese National Dental Examination. Because these non-metal clasp dentures are metal-free, they are safe for patients allergic to these materials. However, the reality is that, although non-metal clasp dentures have superior esthetics and comfort, there is little information on their use and design. We surveyed dentists working at Osaka Dental University to ascertain their attitudes toward non-metal clasp dentures, and examined how their experience treating edentulism with this type of prosthesis affected their attitude toward this treatment.

The survey participants were 53 dentists (31 males and 22 females) from the Department of Removable Prosthodontics and Occlusion and the Department of Geriatric Dentistry of the Osaka Dental University. They were asked to compare characteristics such as esthetics, comfort, odor, modifications to the natural teeth (i.e., the amount of natural tooth structure that needed to be removed), stress on the gingivae (i.e., cleansability of the marginal gingivae), strength, difficulty of denture adjustments, tooth mobility, deterioration of the material, and denture design. In addition, the patients were asked to compare satisfaction with the non-metal clasp dentures compared with conventional removable partial dentures, and were asked whether they would recommend this new treatment modality. Each of the dentists answers was then cross-examined against his or her clinical experience with this new type of dental prosthesis.

Of the 53 dentists, 19 had previously made non-metal clasp dentures for their patients (hereinafter referred to as “experienced dentists”) and 34 had not (“inexperienced dentists”). In both groups, about 60% of the dentists, regardless of whether they had clinical experience, rated non-metal clasp dentures highly for their esthetics, appropriateness for patients allergic to metal, and the satisfaction of their patients. Since non-metal clasp dentures are appropriate for patients allergic to metal and for those dissatisfied with metal clasps, it can be inferred that both the experienced and inexperienced dentists were in agreement. In contrast, regardless of their clinical experience, most dentists gave non-metal clasp dentures low ratings for their burden on the gingivae, their lack of strength, their difficulty of adjustment, the extent to which they caused tooth mobility, and the rapid degradation of the denture base material.

Regardless of their clinical experience, the dentists differed on denture design and their evaluation on the stress on the natural teeth. This suggests that, while both groups of dentists were aware of the shortcomings of non-metal clasp dentures, even the experienced practitioners did not have a clear rationale for design of the prostheses. One find-
The demand for removable dentures has been steadily increasing as Japan becomes a super-aging society. At the same time, due to changes in social consciousness, a significant number of patients refuse to use dentures because they are generally perceived as signs of aging. One important reason is that removable dentures tend to have negative esthetic effects. A fundamental motivation for patients to receive prosthodontic treatments is to replace problem teeth and restore esthetics. Therefore, in order to improve the quality of life of their patients, dentists must also consider the esthetics of dentures when using them in prosthodontic treatment.

Prosthodontic treatment for edentulous patients using removable partial dentures can help restore masticatory function and improve quality of life. However, patients may dislike removable partial dentures for esthetic and psychological reasons as they have metal clasp retainers, which are considered unsightly. There have been discussions on the use of permanently attached dental prostheses to treat patients who have high esthetic expectations. However, the removal of a significant amount of tooth structure will compromise the abutment tooth, and fixed prostheses require specialized expertise. For these reasons, fixed prosthodontics are often not recommended. The use of removable partial dentures with metal clasps is further restricted when patients are allergic to metal.

New dental prostheses made of thermoplastic synthetic resins have drawn wide attention in recent years, and are now part of the Japanese National Dental Examination. These so-called non-metal clasp dentures are safe for patients allergic to metal. Since 2007, as elastic thermoplastic synthetic resins became widely accepted as a denture base material, dental practitioners have explored the potential for such materials to serve as denture retainers. Increasingly, clinicians are constructing removable partial dentures made exclusively of resin, or of a mixture of resin and metal. Such removable partial dentures are called "non-metal clasp dentures." They are generally popular among patients because of esthetics. Non-metal dentures are also softer than removable partial dentures made of acrylic resin.

Various materials have been developed for making non-metal clasp dentures. Polyamide (nylon) resins are highly elastic and flexible, while topoly-carbonate resins are relatively inelastic, but less vulnerable to shock and more durable. Polyester, acryl, and polypropylene have also been used. However, existing reviews on these materials are all based on clinical experience and are hence subjective. As dental science progresses, more scientific research should be conducted to improve existing materials and develop new ones.

Clinical trials have already demonstrated the potential of the non-metallic materials discussed above in making denture bases; they are safe, color stable, and popular with patients. However, there is insufficient evidence that non-metal clasp retainers satisfy the requirements and functional characteristics needed for conventional removable partial dentures. There are risks that, because support for the abutment tooth and retention are weak, the use of non-metal clasp dentures may cause harm to the periodontium of abutment teeth and the alveolar ridge near the edentulous area. In addition, "non-metal
clasps require little tooth preparation and are not covered by Japanese National Health Insurance.

There appears to be increasing demand for non-metal clasp dentures. We occasionally come across dentures that cannot attain existing design principles of removable partial dentures. For this reason, the Japan Prosthodontic Society has warned against the overuse of non-metal clasp dentures made of synthetic thermoplastic resins. Non-metal clasp dentures have both merits and demerits. While being effective in restoring smiles, misuse of non-metal clasp dentures may cause serious problems such as alveolar ridge resorption and shifting of the abutment teeth. Therefore, it is necessary to conduct further scientific research on the indications for non-metal clasp dentures.\(^\text{13, 14}\)

At the Osaka Dental University Hospital, dentures that do not use metal retainers have been widely used clinically because of their esthetics. Since esthetics and comfort may prioritize treatment, the selection of non-metal clasp dentures are often made based on the subjective judgement of the dentist and dental technician rather than on dental science. For these reasons, we surveyed hospital-employed dentists to ascertain their attitudes toward non-metal clasp dentures, and examined how the clinical experience that the dentist had with non-metal clasp dentures affected his attitude toward this new type of dental prosthesis.

**MATERIALS AND METHODS**

We surveyed 53 dentists (31 males and 22 females) employed at the Department of Removable Prosthodontics and Occlusion and the Department of Geriatric Dentistry of Osaka Dental University as of December 2015. All questionnaires were answered anonymously. All participants consented to the use of their responses for academic research, presentation and publication. The Osaka Dental University Ethics Committee approved this research project, including the survey (Osaka Dental University Ethics Committee Document No.110872).

The dentists were asked to compare characteristics of the conventional and non-metal clasp removable partial dentures in terms of esthetics, comfort, odor, burden on natural teeth, burden on the gingivae, strength, difficulty of adjustment, tooth mobility, degradation of material, denture design, and patient satisfaction. They were also asked if they would recommend non-metal clasp dentures in the future. The answers of the individual dentists were then examined based on their clinical experience with this new type of dental prosthesis. All questions were multiple choice.

**RESULTS**

**Clinical experience of the dentist with non-metal clasp dentures**

Of the dentists who participated in this survey, 36 (68%) had between 1 and 10 years of clinical experience, 7 (13%) had between 11 and 20 years of clinical experience, 2 (4%) had between 21 and 30 years of clinical experience, and 8 (15%) had 31 years or more clinical experience. Nineteen of them had experience making non-metal clasp dentures and 34 did not. Of the dentists who had made non-metal clasp dentures, 14 had made between 1 and 5 dentures, 2 had made between 6 and 10, and 3 had made between 11 and 15. With regards to the elastic thermoplastic synthetic resins chosen for making the non-metal clasp dentures, 66% were polyester, 19% were polycarbonate, and 15% were polyamide resins. Furthermore, including those dentists who had no experience making non-metal clasp removable partial dentures, 35 (66%) had adjusted this type of denture.

**Characteristics of non-metal clasp dentures compared with conventional removable partial dentures**

Regardless of clinical experience, most dentists thought non-metal clasp dentures were slightly more esthetic than conventional removable partial dentures. Although experienced dentists gave divergent feedback concerning patient comfort, most inexperienced dentists saw no difference (16 participants, 47%). Regardless of clinical experience, most dentists saw no difference in denture odor. As well, regardless of clinical experience, most dentists saw no difference in stress on the remaining teeth.
between the two denture types. Forty-seven percent of the experienced dentists did not think that the non-metal clasp dentures tended to retain more food residue than conventional removable partial dentures. In contrast, 50% of the inexperienced dentists saw no difference while 35% of them thought there was more food residue. Regardless of clinical experience, most dentists either saw no difference on the impact on gingival hygiene, or thought non-metal clasp dentures were slightly inferior to conventional removable partial dentures. Regardless of clinical experience, most dentists said non-metal clasp dentures were slightly stronger and more durable. In both groups, most dentists thought that non-metal clasp dentures were slightly more difficult to adjust, and 10 (29%) of the inexperienced participants said that non-metal clasp dentures were difficult to adjust. Regardless of clinical experience, most dentists either answered that non-metal clasp dentures were slightly more mobile or said that there was no difference.

Whereas most experienced dentists saw no difference in degradation of the denture material, most of the inexperienced dentists believed that non-metal clasp dentures were made of materials that were slightly inferior. Regardless of clinical experience, most dentists said that the clasp materials were unlikely to make any difference in the likelihood of the artificial teeth dislodging from the denture. In addition, regardless of clinical experience, most dentists said non-metal clasp dentures were slightly more difficult to design. Regardless of clinical experience, most dentists believed patients were slightly more satisfied with non-metal clasp dentures.
dentures. Although both experienced and inexperienced dentists tended to believe the demand for non-metal clasp dentures would increase somewhat in the future, most were unable to decide whether they would recommend the use of this new type of dental prostheses to their patients (Figs. 1-15).
DISCUSSION

The increased demand for dentures has led to more people becoming interested in non-metal clasp dentures, a new type of dental prostheses made of thermoplastic synthetic resins that are safe for patients allergic to denture base metals. However, the reality is that while non-metal clasp dentures have superior esthetics and comfort, there is little scientific evidence for their design. We surveyed the attitudes of dentists working at the Osaka Dental University Hospital toward non-metal clasp dentures and examined the impact of their clinical experience with non-metal clasp dentures on how they felt about this new type of dental prostheses.

Our survey showed that approximately 60 percent of dentists, regardless of their clinical experience, rated non-metal clasp dentures highly for their esthetics, non-allergenic properties, and patient satisfaction. In contrast, regardless of clinical experience, most dentists gave non-metal clasp dentures low rating for their impact on gingival health, strength, ease of adjustment, denture mobility after placement in the mouth, and deterioration of the material. In addition, regardless of their clinical experience, the answers of dentists varied on denture design and the stress of non-metal clasp dentures on the natural teeth. This suggests that, while both experienced and inexperienced dentists are aware of the shortcomings of non-metal clasp dentures, even dentists who have clinical experience lack a scientific rationale for their design.

The dentists employed at the Department of Removable Prosthodontics and Occlusion and the Department of Geriatric Dentistry of Osaka Dental University are well engaged in clinical practice and teaching with respect to metal dentures. Hence, we believe their opinions on non-metal clasp dentures are valid. As for esthetics, regardless of clinical experience, most of the dentists surveyed thought non-metal clasp dentures were slightly better than conventional removable partial dentures. Although experienced dentists gave divergent feedback with respect to patient comfort, most inexperienced dentists felt there was no difference.

Regardless of clinical experience, most dentists thought there was no difference in the two treatments with respect to denture odor. As well, both groups of dentists saw no difference in the amount of tooth structure that needed to be removed with the two treatment modalities. Hence, it is appropriate to conclude that reviews are based heavily on the positive esthetics of non-metal clasp dentures. More conventional options for treating edentulism include bridges, dental implants, and metal base dentures. However, tooth replacement with a bridge requires removal of a significant amount of the patient’s tooth structure. Most patients are hesitant to choose dental implants because they fear the surgical process of placing metal into their jaw bone. Patients can choose partial dentures if they have the above concerns. However, they may also resist partial dentures because of the poor esthetics of clasps.

While treatment options such as magnetic dentures, attachments and telescopic crowns may meet esthetic demands, patients may worry about damage and stress to their remaining natural teeth. Non-metal clasp dentures become a treatment option for patients because of their reliance on vital teeth for retention. Thermoplastic synthetic resins used in non-metal clasp dentures are more elastic and softer than acrylic resins used in conventional removable partial dentures, and hence are more comfortable to wear. In cases that require designs that ensure rigidity, some dental practitioners may increase the thickness of the denture base. However, overall opinions are divided.

The experienced and inexperienced dentists disagreed on the demerits of non-metal clasp dentures. While most inexperienced dentists said that non-metal clasp dentures tended to retain more food residue, the experienced dentists disagreed. Regardless of clinical experience, most dentists believed that non-metal clasp dentures made self-cleaning of the marginal gingivae more difficult, had slightly less strength and durability, and were slightly less stable than conventional removable partial dentures.
Whereas most inexperienced dentists believed that non-metal clasp dentures were made of less durable materials, most experienced dentists did not see much difference. Both groups of dentists tended to believe that the denture teeth were unlikely to dislodge regardless of the clasp material. Overall, there was no objection to the clinical use of non-metal clasp dentures made of currently available thermoplastic synthetic resins. However, as noted below, non-metal clasp dentures are designed to blend in with the gingivae, thus completely covering the cervix of the abutment tooth. Consequently, inexperienced dentists tended to believe that non-metal clasp dentures were more likely to keep food residue near the undercut areas. Interestingly, experienced dentists gave opposite answers for the exact same reason, because they had seen various efforts being made to improve the design of the cervical region of the denture. Nonetheless, both groups agreed that non-metal clasp dentures were more likely to cause periodontal disease than conventional removable partial dentures, and hence patients using these dentures should pay more attention to cleaning.

With some exceptions, most users reported that the smooth surfaces of their non-metal clasp dentures wore away several months after placement. This wear occurred because the surface hardness of thermoplastic synthetic resin is lower than that of acrylic resin, making it easier for it to lose gloss. In addition, the hard surface of non-metal clasp dentures is difficult to polish. However, improvements have been made and polishable materials are now available. This may explain why only experienced dentists felt little difference between non-metal clasp dentures and conventional removable partial dentures in terms of degradation in the material. Breakthroughs in material science may decrease the likelihood of dislodgement of denture teeth.

At this stage, there is no clear agreement on the indications for and proper design of non-metal clasp dentures. It is important that the design insures that the functioning denture exerts even forces on the remaining teeth and the alveolar ridge adjacent to the edentulous area. It is also important that the denture is retentive and provides sufficient support for the remaining teeth. The design of non-metal clasp dentures may sometimes omit both metal clasps and rests, contrary to the principles of conventional denture design. As a result, they may be difficult to adjust. Therefore, regardless of clinical experience, most dentists said that non-metal clasp dentures were more difficult to adjust. The absence of proper evidence for their design may also help explain why dentists surveyed were unable to decide whether they would recommend this new type of dental prostheses. On the other hand, both groups of dentists concurred that patients tend to have high expectations of non-metal clasp dentures and that the demand for non-metal clasp dentures will continue to increase. Hence, it is necessary to establish clear evidence for the clinical use of non-metal clasp dentures.

CONCLUSION

There is basically a consensus of opinion on the merits and demerits of non-metal clasp dentures among dentists regardless of their clinical experience with this new type of prostheses. Lack of knowledge about improvements in denture materials and designs has led to disagreements on some characteristics of non-metal clasp dentures among experienced and inexperienced dentists surveyed in this study. At the same time, both groups of dentists agreed that there is still room for improvement in denture design. As most dentists predicted that the demand for non-metal clasp dentures would continue to increase, it is necessary to standardize the fabrication and clinical application of this new type of dental prosthesis.

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