Retention of magnet structure using soft lining material and photopolymerization denture base resin

S. Okayama, H. Shimpo, Y. Suzuki, C. Ohkubo

Department of Removable Prosthodontics, Tsurumi University School of Dental Medicine

---

Introduction

Magnetic attachments are widely used for retention of overdentures in prosthetic rehabilitation. In general, a magnet is directly mounted to the denture base using auto-polymerized polymethyl methacrylate (PMMA) resin by the brush-on technique after the keeper is set to the abutment tooth or the dental implant. However, special care must be taken when magnetic attachment is mounted to the denture base using auto-polymerized 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 structure with three wing undercuts has been developed that can be mounted to the denture base using a soft lining material or photopolymerization resin (Fig. 1).

Modified magnet structure

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

Objective

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

Materials and Methods

The magnetic structure (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 attachment (Nissin, #000; 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 retaining magnet 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, Tokuyama Dental, TLR; and MILD REBARON LC Co., Ltd., MRL). In addition, a mixed resin, in which 40 % PMMA resin was added to 60 % soft lining polymer material, was used in this study. As a surface treatment, metal primer (ALLOY PRIMER, Kuraray Co., Ltd., P) and bonding material (Super-Bond, Sun Medical Co., Ltd., SB) were applied on wing undercuts. Specimens without surface treatment (N) were also prepared. After surface treatments, magnets were mounted in the resin housing using soft lining material, photopolymerization denture base resins, and mixed resins (Fig. 3). The tensile strengths were measured using an 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 Form of the modified magnetic attachment

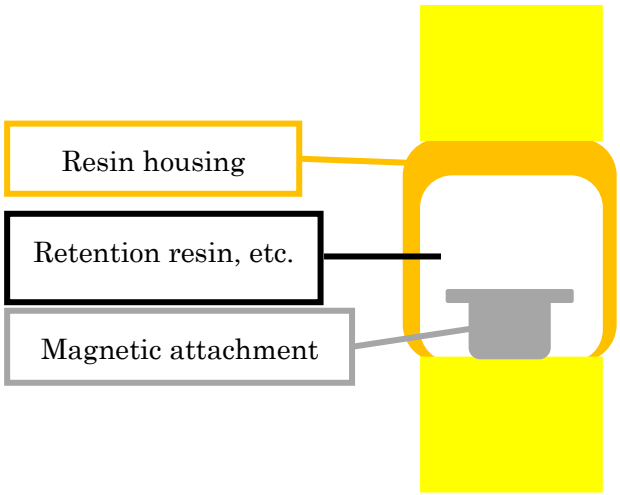

Fig. 3 Mounting of the magnetic attachment

Fig. 4 Autography

Results

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

The specimens that used a soft lining material with 1.5 times the amount of polymer demonstrated 1.2–1.5 times higher retentive forces than did those that used the standard P/L ratio ($p< 0.05$) (Fig. 6). The retentive forces of two photopolymerization denture base resins and a mixed resin are shown in Fig. 7. TLR and MRL showed retentive forces similar to those of the control and the modified magnet. Using the mixed resin, the modified magnet with a 5.5-mm wing undercut demonstrated higher retentive forces than did the 4.5 mm and control ($p< 0.05$).

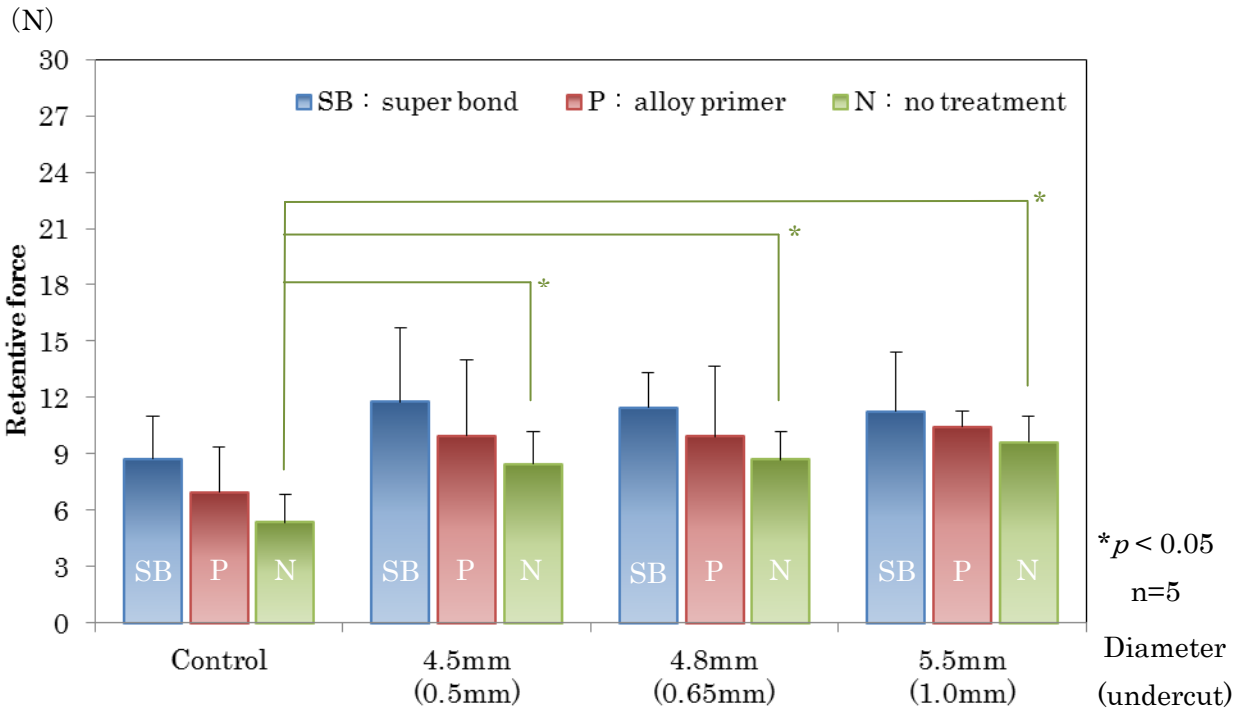

Fig. 5: Soft lining material in standard P/L ratio.

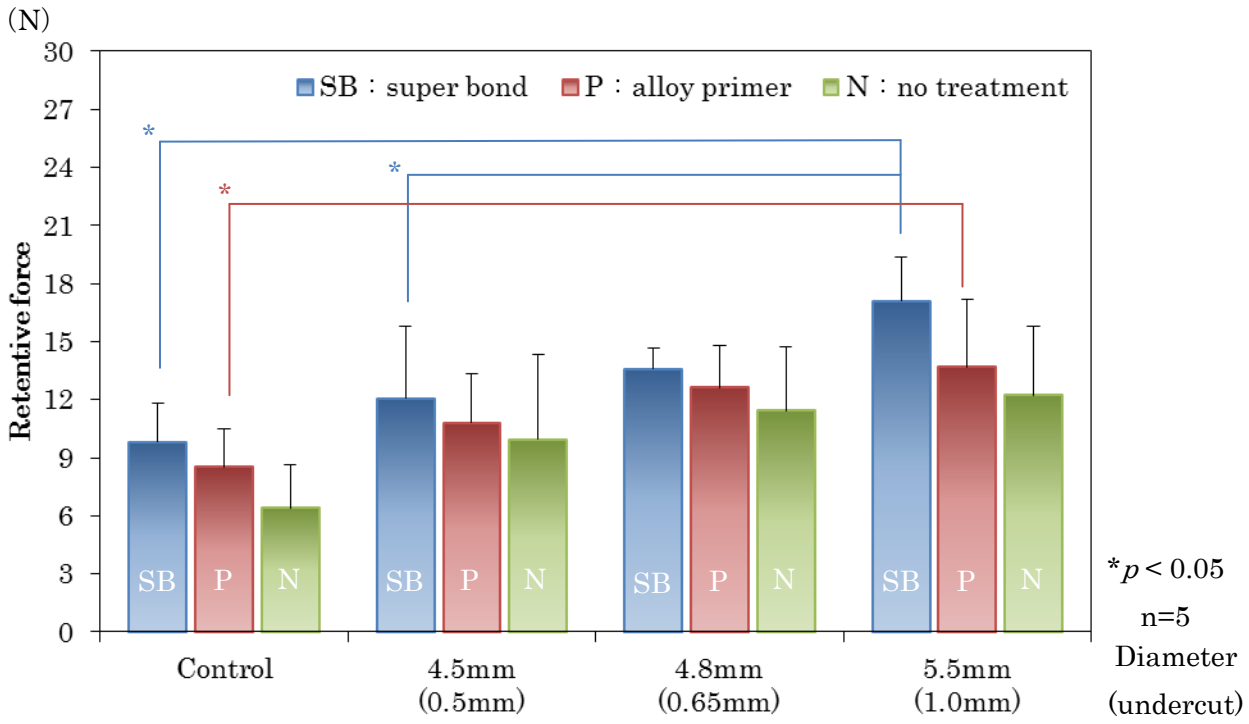

Fig. 6 soft lining material a rate of using that is powder volume 1.5 times.

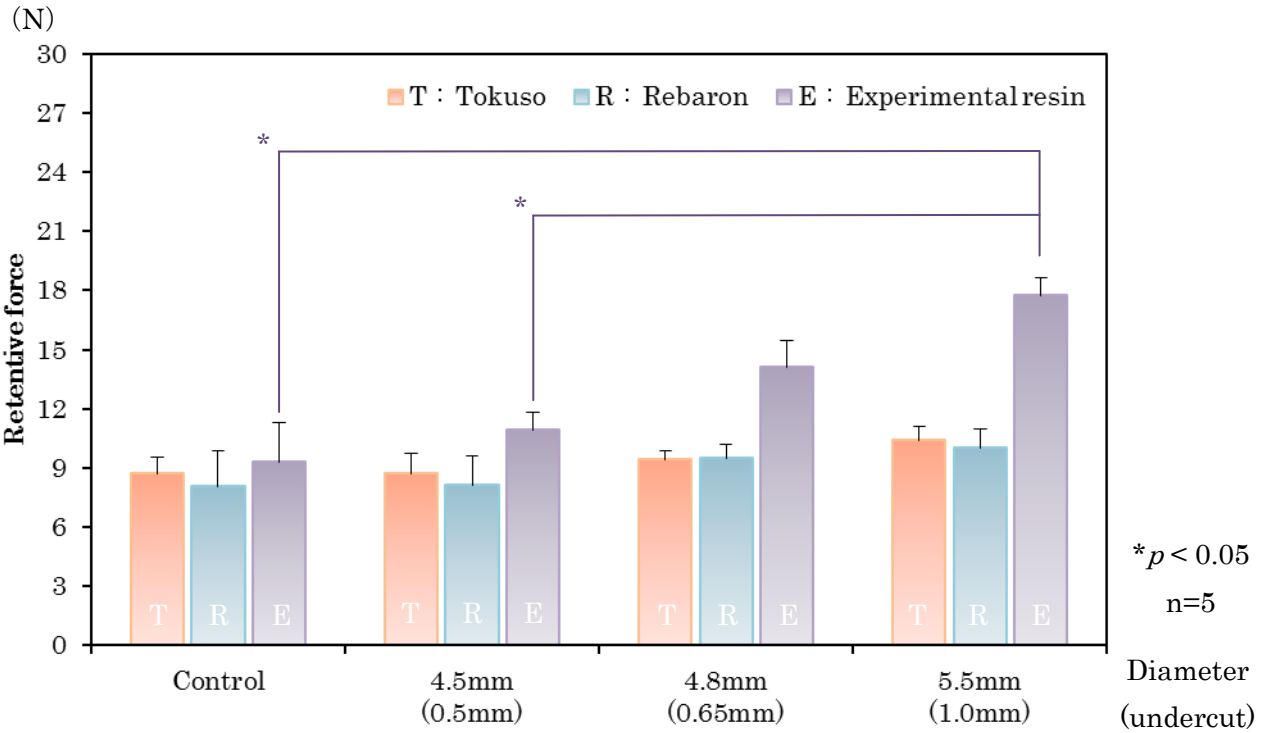

Fig. 7: Two photopolymerization denture base resins and experiential resin

(soft lining material hardness: 1.5 times)

Conclusion

The retentive forces of all modified magnetic attachments showed 8.79 N–17.12 N, and the attractive force of the magnetic attachment was approximately 5.5 N. Therefore, the modified magnetic attachment would be retained in a denture base that used a mixed resin and a photopolymerization acrylic resin.