

Complications During Herbst Appliance Treatment

ETJE SANDEN, DDS, DMD
HANS PANCHERZ, DDS, OD, FCDS HK(Hon.)
KEN HANSEN, DDS, OD

The Herbst* appliance¹ is now the most commonly prescribed functional appliance in the United States. Although it has been used in modern orthodontics since 1979,² its design has changed over the past two decades. At the Department of Orthodontics of the University of Giessen, we initially used a banded Herbst appliance, but after frequent complications such as band loosening and breakage, we have used a cast-splint Herbst appliance since 1995.

The present study was conducted to com-

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pare the banded and cast-splint Herbst appliances in three types of complications:

1. Breakage of bands or splints.
2. Breakage of telescoping mechanisms.
3. Loosening of bands or splints.

Materials and Methods

We evaluated 316 consecutively treated Herbst patients, of which 134 patients (82 male, 52 female) were treated with a banded Herbst and 182 (93 male, 89 female) with a cast-splint Herbst appliance. The average treatment time for

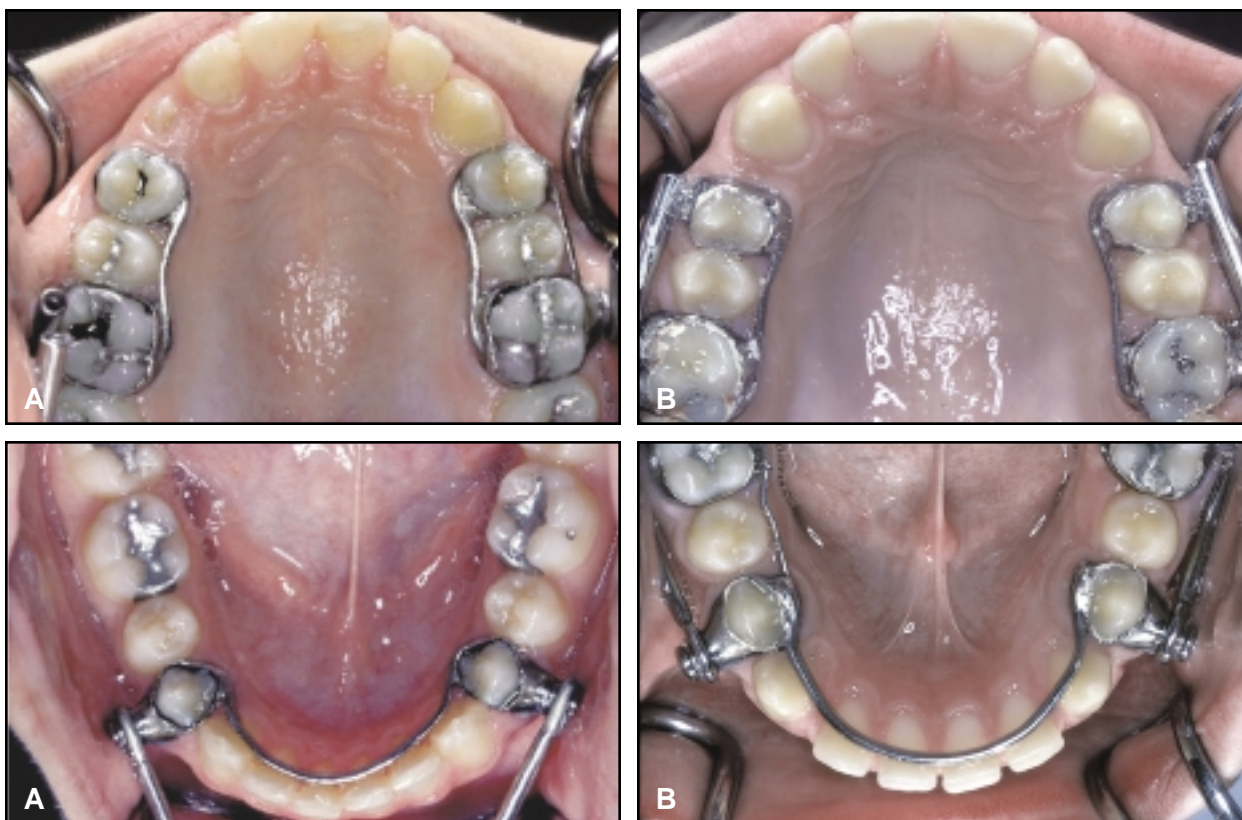


Fig. 1 Banded Herbst appliance. A. Partial anchorage. B. Total anchorage.

Dr. Sanden is an Assistant Professor and Dr. Pancherz is Professor and Head, Department of Orthodontics, University of Giessen, Schlangenzahl 14, D-35392 Giessen, Germany. Dr. Hansen is an Associate Professor, Department of Orthodontics, University of Gothenburg, Sweden. E-mail Dr. Pancherz at hans.pancherz@dentist.med.uni-giessen.de.



Dr. Sanden



Dr. Pancherz



Dr. Hansen

both designs was seven months.

Two forms of anchorage were used for the banded Herbst appliance (Fig. 1). Either the mandibular first premolars only (partial anchorage) or the first premolars and first molars (total anchorage) were banded. The first premolars were connected with a sectional wire contacting the lingual surfaces of the anterior teeth. With both types of mandibular anchorage, the maxillary first premolars and first molars were banded and connected with sectional lingual wires.

In the cast-splint Herbst appliance, the bands were replaced by cobalt chromium splints



Fig. 2 Cast-splint Herbst appliance.

(Fig. 2). In the maxillary arch, the splints covered the premolars and first molars; in the mandibular arch, the canines, premolars, and first molars. The splints in both arches were connected with sectional wires.

Brown copper cement was used to attach the banded appliances, and glass ionomer cement was used for the cast-splint appliances.

Results

There were no significant differences in complications of treatment between male and female patients or between the partial- and total-anchorage banded Herbst designs. Therefore, the male and female patients and the partial- and total-anchorage groups were pooled for calculation of the final results.

Of the 134 banded Herbst patients, 44 (33%) showed no complications during treatment. The remaining patients experienced 379 complications, which were categorized as follows: 17.4% maxillary band breakages, 12.4% mandibular band breakages, 5.8% telescope breakages, 42.2% maxillary band loosening, and

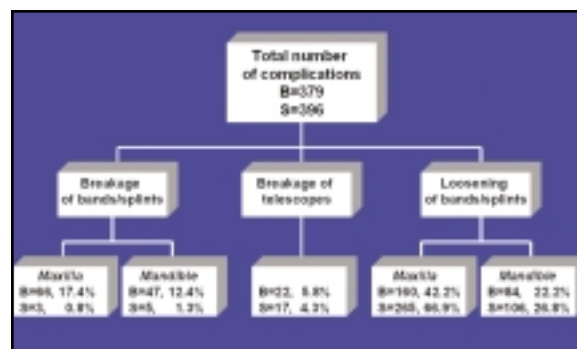


Fig. 3 Frequency and type of complications in 90 subjects treated with banded Herbst appliance (B) and 110 subjects treated with cast-splint Herbst appliance (S).

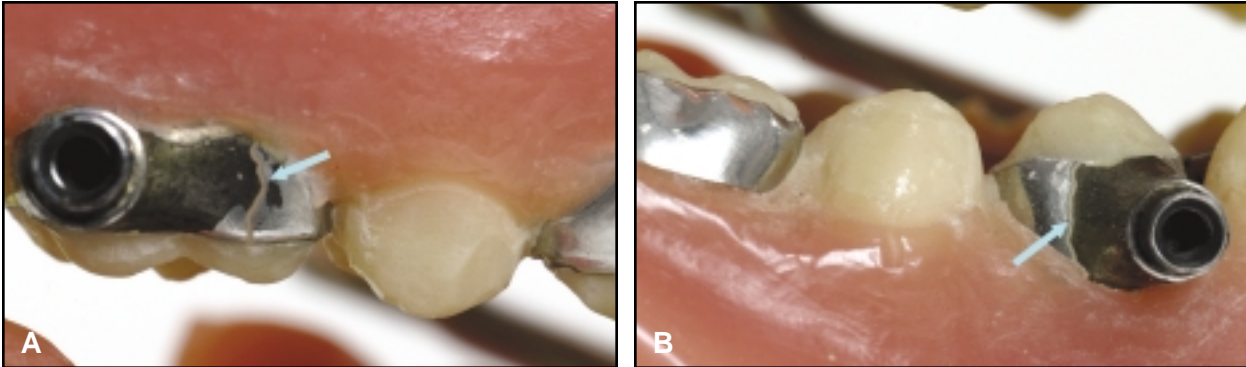


Fig. 4 Common band breakages. A. Mesio buccally at maxillary first molar. B. Distobuccally at mandibular first premolar.

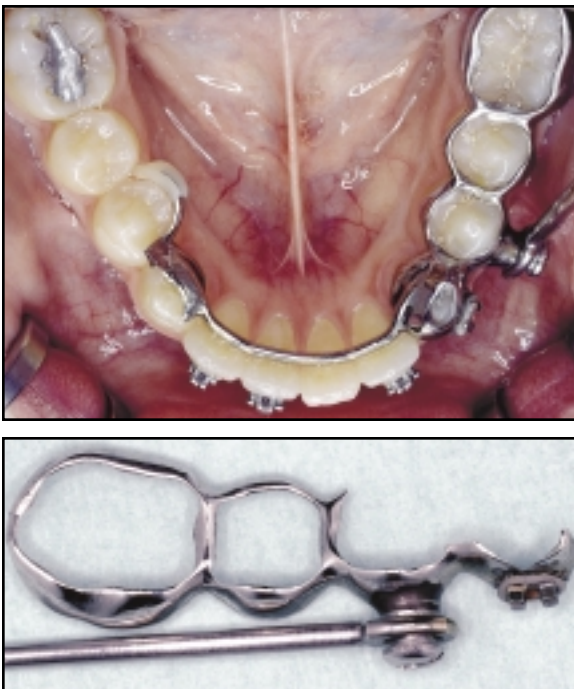


Fig. 5 Cast-splint breakage at mandibular first premolar.

22.2% mandibular band loosening (Fig. 3).

Seventy-two (40%) of the 182 cast-splint Herbst patients had no complications at all. The remainder experienced 396 complications: .8% maxillary splint breakages, 1.3% mandibular



Fig. 6 Bent plunger and split tube of telescoping mechanism.

splint breakages, 4.3% telescope breakages, 66.9% maxillary splint loosening, and 26.8% mandibular splint loosening (Fig. 3).

Of the 90 banded Herbst and 110 cast-splint Herbst patients who had complications, 55% experienced one to three problems, 29% four to six problems, 13% seven to 10 problems, and 3% more than 10 problems.

Discussion

Bands were considerably more likely to break than the cast splints were. The splints are

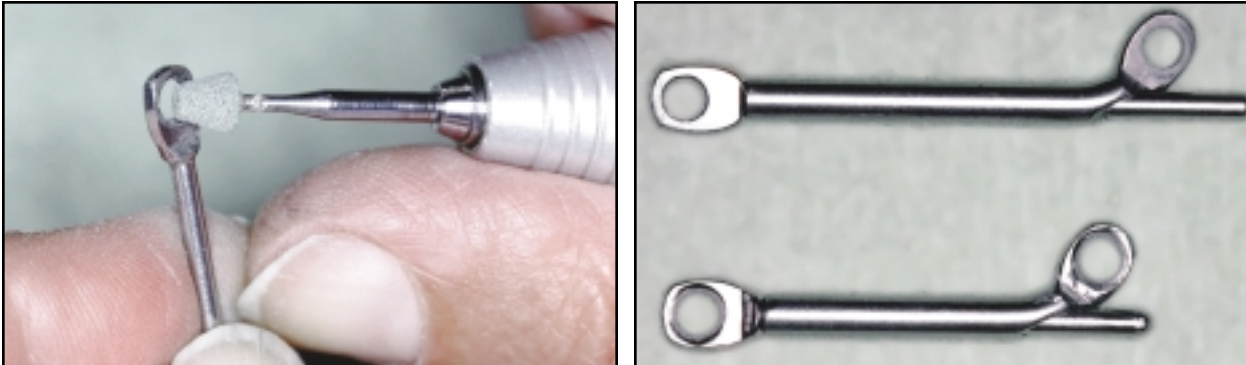


Fig. 7 Pivot openings of plunger and tube widened to enhance lateral movement of mandible.

much thicker than the .15-.18mm band material, which is further weakened by soldering when the axles are attached to the bands. Because of the forces acting on the upper and lower anchorage teeth, the majority of band breakages were seen mesiobuccally at the maxillary first molar bands and distobuccally at the mandibular first premolar bands (Fig. 4). The few cast-splint breakages noted were caused by the casting material being too thin (Fig. 5).

Telescope breakage was about equally common in both groups. This complication tends to occur in patients who can open their mouths so wide that the tube and plunger nearly disengage from each other. The patient then panics, closing the mouth so forcefully that the plunger gets stuck in the tube opening and bends or causes the tube to split (Fig. 6). Patient education is important in preventing this problem, as is ensuring that the plunger is long enough.

Loosening was the most common complication in both types of Herbst appliances, with maxillary problems seen twice as often as mandibular problems. The splints loosened more often than the bands did, which could be due to differences in the retention of the two appliances. The splints did not cover the interproximal areas and were extended only halfway down the teeth occlusogingivally. The bands, on the other hand, covered the interproximal tooth surfaces and

were extended as far as or past the gingival margins.

The type of cement did not seem to affect the retention of the appliances. A scientific comparison has not been conducted between the modern glass ionomer cement and the older copper cement. In our department, to reduce the incidence of splint loosening, we use a light-cured glass ionomer cement, and we etch the tooth surfaces with 37% phosphoric acid in unusually difficult cases.

In general, loosening and breakage of bands and splints are caused by the biting and chewing forces transmitted by the telescoping mechanisms to the anchorage units. An adequate capacity of lateral jaw movement is critical in reducing the lateral component of force transmission. In our department, this is enhanced by widening the pivot openings of the plunger and tube (Fig. 7). The forces acting on the bands and splints can also be reduced by advancing the mandible in stages rather than all at once. Further research is needed in this area.

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