Clinical Studies on K.I. Clasps

by

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Introduction

A variety of devices are employed as direct retainers for removable dentures: clasps such as wire clasps, cast clasps and combination clasps, together with ready-made milled attachments. Of the clasps, the circumferential clasp, which surrounds three surfaces and four line angles, has two particular drawbacks—one related to esthetic considerations, and the other the unpleasantness of the presence of a foreign object. Attachments, on the other hand, have the important disadvantages of being expensive and necessitating removal of a large amount of tooth substance [1,2].

In clinical practice, if one or more teeth are lost, the adjacent teeth generally tend to become inclined towards the gap that is left, and the clinical cervical lines of their interproximal surfaces drop in the direction of the roots. The result is that a fairly pronounced undercut appears.

From the viewpoint of denture retention, since the maximum retentional force acts when a denture breaks away, it is extremely useful to take advantage of the relatively large undercut area that is produced on the interproximal surfaces [3].

In such cases, a good course of action—when retention, support, bracing, appearance, the question of comfort, and economic considerations are all taken into account—is to make use of retainers which combine the advantages of both clasps and attachments.

This paper reports our experimental investigation of the retentional force and the clinical application of K.I. clasps (interproximal retainers) [4] which are effective in the circumstances outlined above.

Materials and Methods

1. Clinical Applications
   1) Indications
      The indications for these K.I. clasps are Kennedy class III and class IV [5].
   2) Bending of K.I. clasps
      The wire employed was 0.9 mm Co-Cr wire. The details of the bending varied according to whether the teeth concerned were anterior or posterior, but the method was fundamentally the same. Where the clasp was to be used for anterior teeth,
first the lower part of the survey line was made to conform to the curve of the gingival margin, as shown in Fig. 1. Next, the wire was bent back at the line angle on the lingual side of the tooth, and was fitted along the survey line towards the incisal margin. After this, it was bent back again slightly to the lingual side of the long axis.

Where posterior teeth are involved, as shown in Fig. 2, the process is a little more complicated, but can be considered as a combination of two of that for the clasp for anterior teeth. In addition, for both anterior and posterior teeth (see Fig. 2), it is necessary to leave the removable space between the arm and the tang of the clasp.

A K.I. clasp fashioned according to the above procedure is shown in Fig. 3. The rest was made separately of Co-Cr wire, and was inserted into the saddles together with the legs, or, alternately, the rest plate was soldered to the clasp [6, 7].

3) Preparation of denture

After the clasp, the denture was made by the conventional method. However, between the flaking of the denture and the completion of polymerization of the resin, the space plate was inserted into the removable space. Also, at this point, it is essential to secure the removable space.

4) Denture placement method

As is shown in Fig. 4, if placement were carried out perpendicularly to the
occlusal plane, it would not be possible to place the denture into both retainers at once. Consequently, one side—either the mesial or the distal—was placed in first, as can be seen in Fig. 5, and then the other side was inserted (Fig. 6) [6,7].

2. Measurement of Retentional Force
   1) Preparation of experimental model
      A modified Kennedy class III master cast of one missing tooth was made of extra-hard plaster (super-stone). Then, two teeth—the second premolar and the second molar—were prepared in order to serve as abutment teeth, and a crown was cast from an Au-Ag-Pd alloy, having an undercut of 0.25 mm at approximately one-third of the way from the cervical line. This cast crown was finally cemented onto the clasped tooth so as to produce the experimental cast (Fig. 7).

   2) Making an experimental denture
      A class III K.I. clasp was shaped of 0.9 mm Co-Cr wire, using an experimental cast. The rest was fabricated separately on a Co-Cr plate, and inserted into the saddles with the legs. After the retainers had been prepared in this manner, the saddles and a heat-cured acrylic resin block whose artificial tooth portion was 25 mm high by 23 mm (bucco-lingual) by 50 mm (mesio-porximal) were made. In this resin block, 0.9 mm Co-Cr wires for measuring retentional force were buried in both the buccal and lingual sides of the experimental denture saddles. (see Fig. 8).

   3) Measurement of retentional force
      The experimental denture was mounted on the cast, the 0.9 mm Co-Cr wire connected to the denture was drawn upwards, and the maximum retentional force
measured as the denture was drawn away from the cast was recorded. Five experimental dentures were made, and the retentional force was measured three times for each of them with a Model 1123 Instron Universal Testing Machine, and
recording was performed with a full scale of 500 g, a head speed of 10 mm per minute, and a chart speed of 200 mm per minute.

Results

1. Clinical Case
The results for the cases in which K.I. clasps were used are shown in Fig. 9 for Kennedy class III, and in Fig. 10, for Kennedy class IV. It may be clearly seen from these figures that these clasps are not only economical and esthetic in appearance, but also offer ample retention and support for use in clinical practice.

2. Retentional Force
The results obtained in the 15 measurements of retentional force are given in Table 1, and some of them recorded on recording paper are shown in Fig. 11. Table 1 clearly shows that the average retentional force recorded for class III where one tooth had been lost was 152 g.

Discussion

1. Clinical Application
The extent to which a K.I. clasp is in contact with the surface of the tooth is as follows: it vertically straddles the survey line of the interproximal surface, and as a rule touches one surface or one surface and two line angles. The patient thus feels little discomfort due to its presence, and also it has an esthetic appearance. However, as far as the extent of contact is concerned, in certain cases, such as when the amount of undercut is greater than 0.25 mm, or when another clasp is employed in conjunction with the K.I. clasp, pitching and rolling of the denture can probably be prevented at only one interproximal surface.

Moreover, in such cases, there is no need for the contact to extend as far as the labio-lingual portion of the line angle, but when the surfaces adjacent to the location of the missing tooth or teeth are comparatively flat, it is probably preferable to extend the contact to one surface and two line angles, and to bring the ends of the clasp as far as the line angle of the labio-lingual surface. In our two clinical cases, with Kennedy IV, since hooks were also used, the retentional force was quite adequate.

2. Measurement of Retentional Force
In relation to the retentional force of the clasp, when physiological functions such as mastication and phonation were carried out with the denture in place in the mouth, all elements of the denture resisted any tendency to break away. The maximum permissible physiological limit at which teeth can withstand other intraoral forces has not yet been fully clarified, but it is the author’s opinion that in general, a retentional force of up to 1 kg is suitable for a clasped tooth. Therefore, in such cases as the present ones, if an inexpensive K.I. clasp, which is esthetically pleasing and does not cause discomfort, is being considered, the effects of the amount of undercut and the material of the wire employed will be significant. Thus, in relation to the measurement of the retentional force of the wire, a study
was first made of the method that should be used for placement. As a result, in the placement of the K.I. clasp, a mesio-distal clasp is not placed perpendicular to the occlusal plane at the same time, but it is first placed on the mesial side and then on the distal side. Accordingly, the wire for the measurement of the retentional force was buried on the mesial side.

The retentional force measured by this procedure was 152 g, which can be considered to have little or no detrimental effect on the clasped teeth.

**Conclusion**

The clinical application and retentional force of K.I. clasps were studied, with the following results.

1. In clinical use, the K.I. clasp does not necessitate the preparation of clasped teeth, has a good appearance, is inexpensive, and causes little discomfort within the mouth. The retentional force and support were quite sufficient.

2. Using an experimental cast, this clasp was employed for an experimental denture, and its retentional force was measured at 152 g.

**References**