

TECHNICAL NOTES

WEDGE ADAPTORS FOR ALIGNMENT OF LOWER-LIMB PROSTHESES

During the past three years I have used wedge adaptors in the alignment procedure of lower-limb prostheses in two ways: by themselves in determining alignment, and as a means of duplicating alignment that has been determined with the Winnipeg wedge-disc alignment unit (1, 2).

I have found that, when using the Winnipeg wedge disc units, once a satisfactory alignment has been achieved no changes are required later in the majority of cases. Therefore, I designed a series of adaptors (Fig. 1) to aid in duplication of the alignment determined with the Winnipeg wedge discs so that the unit could be used over and over, and also to lessen the problems of loosening and the consequent slippage that had been experienced with the multiple wedge discs.

The wedge adaptors have seen greatest use at the foot connection and under the socket in the below-knee (BK) prosthesis (Fig. 2). They are also used at the foot in above-knee, knee-disarticulation, and hip-disarticulation prostheses. A prefabricated rubber cosmetic cover or a custom-made plastic-laminate cover is used.

By duplicating the Winnipeg wedge discs with the wedge adaptors, the problem of disc slippage has been eliminated. When an adaptor replaces a wedge disc unit under the socket and over the foot a total weight reduction of approximately 4 ounces is realized.

WEDGE ADAPTORS

Five configurations (Fig. 3) with angulation of 0, 2, 4, 6, and 8 degrees, respectively, have proven to be adequate in meeting the alignment needs of our patients. Each adaptor is made from 2024ST4 aluminum round stock and weighs approximately 2½ ounces. (A Winnipeg wedge disc unit weighs approximately 4½ ounces.)

A moveable wedge nut (Fig. 3B) within the



Fig. 1. A 0° adaptor and an 8° adaptor with wedge nut.

adaptor is used to connect the adaptor to the foot with the standard bolts, except for the 0° adaptor (Fig. 3A) which obviously does not require a wedge nut.

ALIGNMENT DUPLICATION BY ADAPTORS

A short review of the Winnipeg wedge disc unit is presented here for those not familiar with this alignment device. Each unit consists of two wedge discs, each having an angulation of 6° (Fig. 4), to make possible a total angulation in one plane of 12° (Fig. 5) and 6° each in two planes. When both discs are moved synchronously, angulation occurs in one plane. To provide angulation in two planes the discs are moved independently of each other.

A detailed description of the principle and use of the Winnipeg wedge disc unit is given in Figures 6 through 11.

In duplicating the alignment, the angulation produced by the wedge discs in one or both planes is determined and the required wedge adaptor is substituted, using the following rules:

1. Determine which quadrant or quadrants the thin edges of both wedge discs are acting upon (Figs. 6 and 7).
2. The maximum number of degrees a wedge

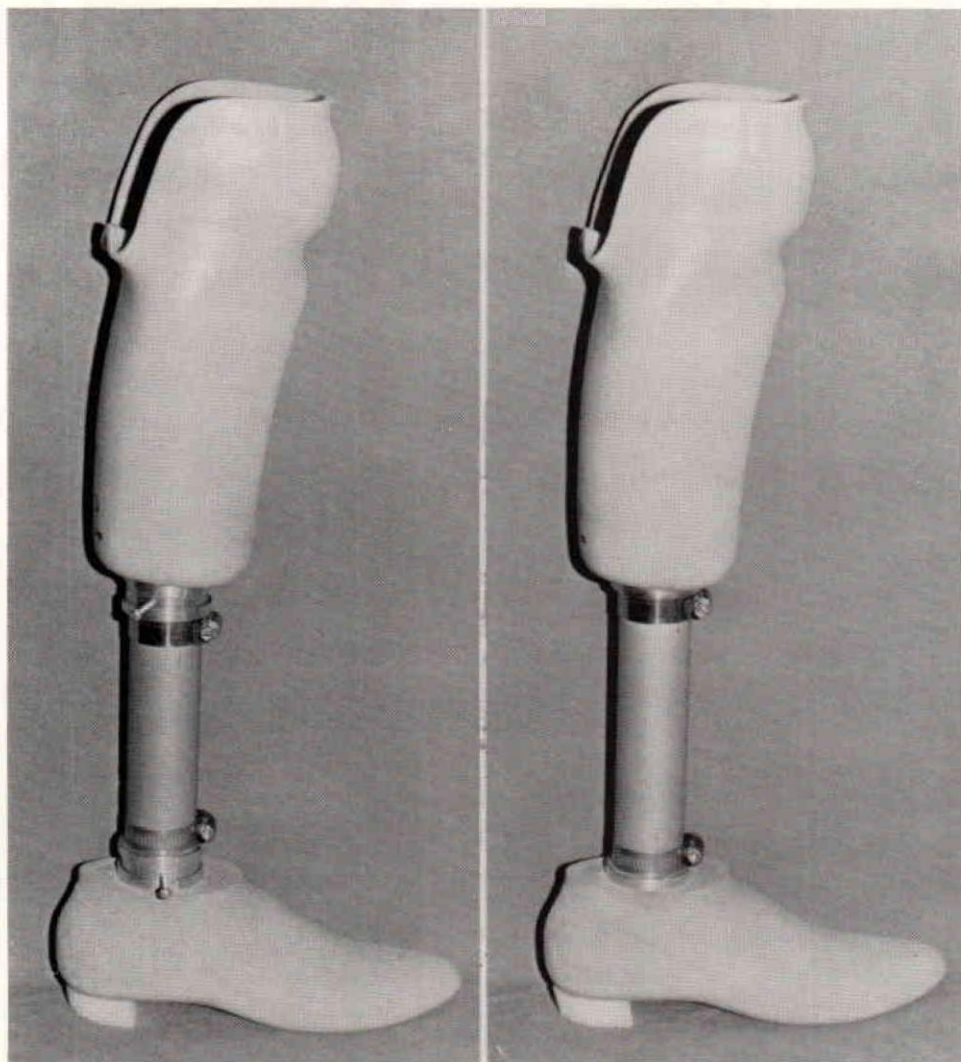


Fig. 2. *Left*, a wedge disc unit that is producing 4° flexion at socket and 0° at the foot connection. *Right*, the wedge discs are replaced with a 4° wedge adaptor under the socket and a 0° adaptor at the foot.

disc has is 6, and this must be shared by the direction in the quadrant or quadrants it is acting upon (Figs. 8 and 9).

3. Add the effects of the wedge discs (Figs. 10 and 11).

Duplication can be performed by using the Hosmer Vertical Fabrication Jig or drawing reference lines on the prosthesis for duplication by eye.

When the wedge disc units are replaced by the wedge adaptors, the pylon tubing must be lengthened to accommodate for the shortening that occurs inherently.

ALIGNMENT PROCEDURE USING ADAPTORS

Bench alignment of the BK prosthesis is performed in the usual manner, appropriate adaptors being placed beneath the socket and over the foot. During dynamic alignment, adaptors are changed as required until the alignment is satisfactory.

Carrying out alignment changes in one or two planes is a simple matter with these adaptors. For example, an 8° adaptor can produce 6° in an interior direction and 2° in a lateral direction (Fig. 12). If a reduction from 6° to 4° is desired in the

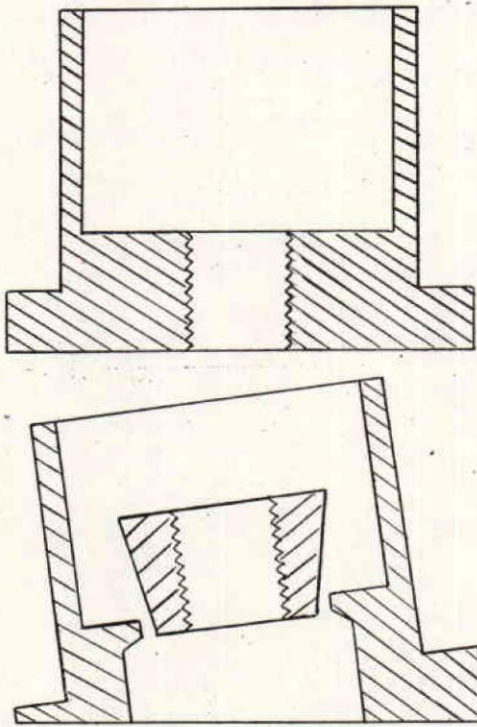


Fig. 3. Drawing of (A) a 0° and (B) an 8° wedge adaptor.

anterior direction while maintaining the 2° in the lateral direction, a 6° adaptor will perform the adjustment (Fig. 13).

DISCUSSION

In using wedge adaptors for determining alignment the prosthetist is concerned only with one quadrant of angulation and two directions (Figs. 7, 12, and 13). When using the Winnipeg wedge discs he often is concerned with two quadrants and three or four directions (Figs. 10 and 11). I have found the wedge adaptors easier to use than the Winnipeg wedges in determining alignment.

CONCLUSION

Wedge adaptors have been found useful as an alignment tool and as a duplication method in a modular type of prosthesis. Ease of adjustment has made changing alignment a simple matter.

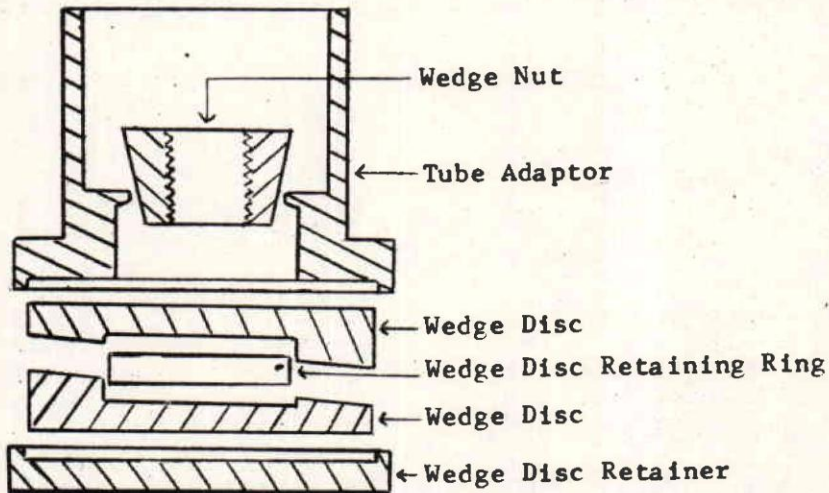


Fig. 4. Sketch of a Winnipeg wedge disc unit.

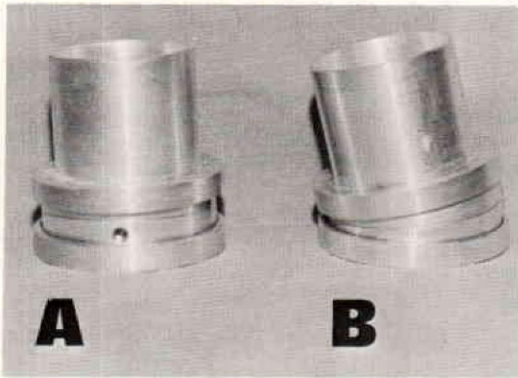


Fig. 5. Winnipeg wedge disc unit in (A) neutral (0°) and (B) 12° of angulation.

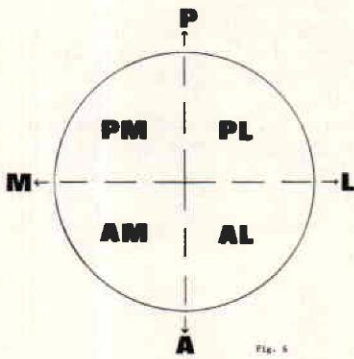


Fig. 6

Fig. 6. Alignment adjustments occur in one or two planes. AP: anteroposterior plane, and ML: mediolateral plane. The two planes produce four quadrants: AM, AL, PM, and PL.

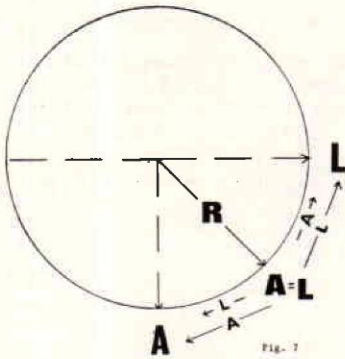


Fig. 7

Fig. 7. When quadrant AL is bisected by a wedge, the angulation produced in direction A and direction L is equal. When the thin edge of the wedge is moved towards A, the angulation in A direction increases while L decreases. The converse is true when the thin edge of the wedge is moved towards L.

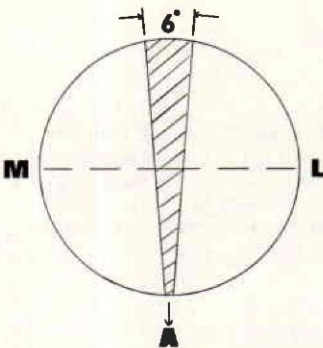


Fig. 8. One of the two 6° Winnipeg wedges produces 6° of angulation in direction A when the thin edge of wedge is centered exactly at A.

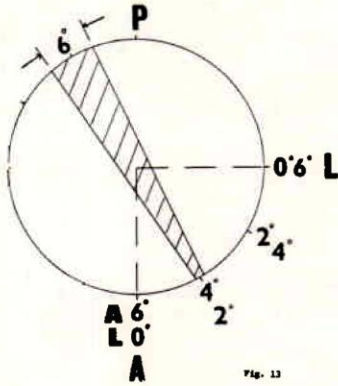


Fig. 13. To produce 4° in direction A and 2° in direction L, a 6° adaptor is chosen, and quadrant AL is divided into thirds so that each third produces a 2° change in angulation. The thin edge of the wedge positioned at the lower third of the quadrant produces the desired angulation.

REFERENCES

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