Prevention Of Dental Arch Collapse In Cleft Palate

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Dental arch collapse is characteristically seen in the more severe types of postoperative cleft palates. Several recent investigators have indicated that this phenomenon is more directly related to lip repair than to palatal surgery.[4,5,6,7,12,15,16,21,22,23] The principles involved have been appreciated by clinicians for over a century.[1,17]

Since one obvious result of arch collapse is alteration of the normal occlusal relationship, it is not surprising that orthodontists with wide experience in cleft palate rehabilitation have developed a clear concept of the immediate and long range effects of this phenomenon. In 1954 Harvold wrote:

"If this medial displacement of the alveolar process takes place before all the teeth are fully erupted, which it generally does, then a corresponding reduction of alveolar growth in height will be noted. When the arch is compressed, the canine and premolars erupt lingually and the normal vertical growth of the alveolar process is obstructed by the tongue. . . ." 8, p. 495.

"The conclusion which may be drawn from these studies is that the major part of the deformities seen in the cleft lip and palate cases cannot be due to reduced growth potentials. The narrow dental arches may be attributed to a change in maxillary bone position and a concomitant inhibition of vertical alveolar growth. . . ." op. cit. p. 506.

Subtelny, in 1954[21] and again in 1957,[22] directed attention to this aspect of the problem. His conclusions, like Harvold's,[9] were based on cephalometric x-ray techniques:

". . . This (surgical) restoration of the muscular integrity of the lip initiates a molding influence. In some cases, this molding results in an approximation of the two alveolar segments; in others, it is of sufficient strength to over-rotate the segments medially. The alveolar process of the smaller maxillary segment may become contained within the premaxillary alveolar element of the larger segment." 24, p. 693.

The inhibition of alveolar growth and development resulting from arch collapse has also been cited by Posen,[15] Swanson,[23] and Johnston.[12] In addition, Swoiskin,[24] and Posen,[16] have shown that asymmetry of form and abnormalities of vertical growth may be "transmitted" to the mandibular arch as a result of the altered occlusal relationship.

It should also be noted that retrodisplacement of the alar attachment and inadequate support of the nostril floor on the cleft side are features which characteristically, and necessarily, accompany alveolar arch collapse. The resulting cleft lip-nasal deformity is well known to plastic surgeons and, though several ingenious methods for its correction have been proposed, the underlying asymmetry of the facial skeleton imposes definite limitations on the success of surgical treatment without orthodontic assistance.

Efforts to prevent such facial skeletal deformities through the use of a dental

This investigation was supported by a research grant (D-197) from the National Institute for Dental Research of the National Institutes of Health.

guide plane were first supported by McNeil of Glasgow who stated:

"The technique employed in this aspect of treatment involves the use of simple intra-oral appliances. They are constructed on a series of models modified progressively towards normality. Their function is to mold the deformed arch into correct anatomical alignment." 13, p. 194.

Later Burston of Liverpool, also an orthodontist, studied with McNeil and became an adept advocate of this technique. In support of this approach he states:

"Once this collapse has been established, the teeth, particularly the canines on the affected side(s) will encyst into incorrect occlusion. This is of great importance because, as the infant grows older, appositional bone growth of the maxilla becomes increasingly important, as contrasted with sutural growth outlined above. Malocclusion of the teeth at this early age will be likely to produce a profound effect on the developing alveolus, and lead eventually to the gross collapse of the maxillary arch so often seen in later years." 3, p. 30.

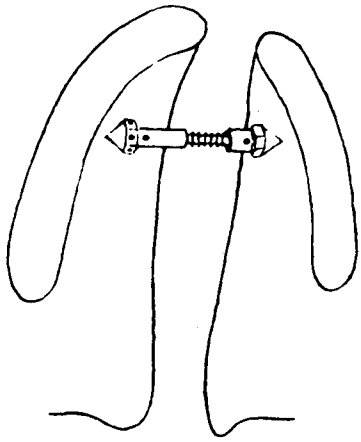
The introduction of bone into the alveolar arch defect was carried out first by Schmid[18] of Stuttgart and by Johanson and Ohlsson[11] in Sweden. Schrudde and Stellmach[19] of Dusseldorf have expertly combined the use of the guide plates to position the maxillary segments with bone grafting of the alveolar defect at the time of lip repair. This now appears to be a most effective approach to the problem and has been pursued and developed at several centers including those of Schuchardt[20] in Hamburg, and Brauer, Cronin and Reaves[2] in Houston.

In 1955, stimulated by discussion of the problem with Dr. Wendell Wylie, an attempt was made at this Center to formulate a means of preventing dental arch collapse. The method selected was to insert an expandable stainless steel bar at the time of lip repair to support the dental arches in compression. A

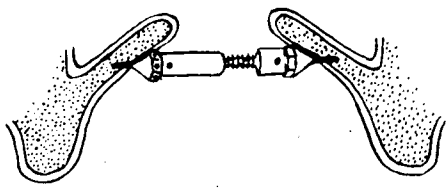
Fig. 1

detailed description of the device and technique together with preliminary report of its effectiveness was published in this Journal in 1957.[5] In order to prevent collapse of the dental arch support in compression is necessary. This support is provided at the time of lip surgery before the teeth have appeared. An expandable bar of stainless steel consisting of a screw and a threaded cylinder was devised for this purpose. The ends are broad for weight-bearing, except for short extensions which are necessary for the retention of the device.

The palatal bar (Fig. 1) is made seven-eighths of an inch to one inch in length by a skilled machinist. In introducing the device bur holes are drilled into the palatal bones on opposite sides of the cleft. The retention pin is inserted into one hole and a suture, which has previously been wrapped around the cylinder, is pulled. With fixation of the screw the cylinder turns much as a top spins, and its other retention point is directed into the opposite bur hole. A wire is passed through holes in each end of the device to prevent its collapse or aspiration and is carried out through the nostril and



PALATAL BAR
FROM BELOW



PALATAL BAR
CROSS SECTION

Fig. 2

taped to the cheek or forehead. The extension pins for retention of this device penetrate the palatal bone but not the alveolar ridge and do not interfere with the dentition (Fig. 2).

After being in position for about four months the palatal bar is removed as an office procedure. There has been no evidence of infection about the bar, nor have the patients had any difficulty with eating. A few days after removal of the device there is no evidence of the site of its insertion.

Material and Method

To date, such palatal bars have been utilized in the treatment of twenty-eight cleft lip and cleft palate patients, twenty-two of whom have been followed through the second year of life. Of these, fourteen had Type III clefts (clefts of the entire palate and alveolar ridge, bilateral). In each of these cases dental study models were made at approximately eighteen months of age at the time of cleft palate repair. In three patients the palatal bar was removed after being in place less than three weeks because of insecure fixation. The remaining six cases have not attained the age for palatal surgery as yet. The dental study models were analyzed by the technique outlined in another paper.[9] The method for establishing landmarks for measurement was based on occlusal relationships. Bite blocks used for determining occlusal relationships in the palatal bar cases were, of necessity, made with the subjects under general anesthesia. Assuming that bite blocks made under such conditions reflect the existing occlusal pattern, there may be good reason to doubt the meaningfulness of this relationship at age 18 months. Nevertheless, it is felt that the method used gives a valid indication of the integrity of the palatal arch.

Results

The results of this study of dental arch collapse in the Type III cleft palate patients who have had lip repair preceded by the insertion of a palatal bar, but no palatal repair, are seen in Figure 3. In this scattergram it is evident that the dental arch collapse, as indicated by area measurements, is much less pronounced than that seen in the postoperative cleft palate patients operated upon elsewhere without the use of a palatal bar. The regression equation enables the prediction of less asymmetry of the palatal halves as projected into the future. The three subjects from whom the palatal bars were

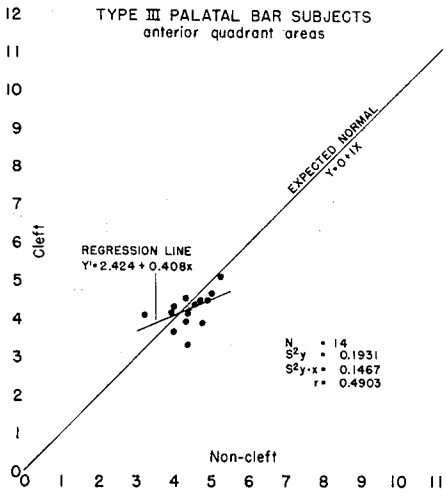


Fig. 3

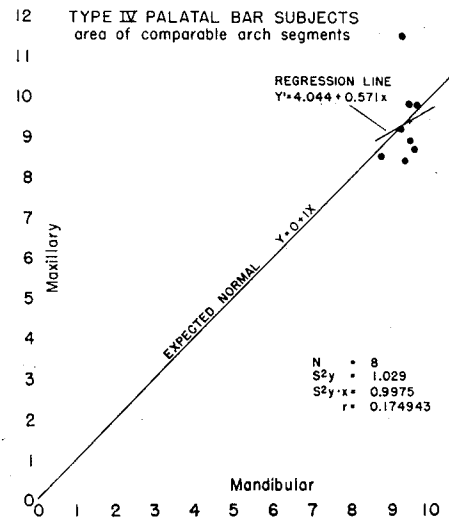


Fig. 4

removed early are included in this study. Examination of their anterior quadrant areas failed to show any deviation from the group average.

Figure 4 is a scattergram indicating the dental arch collapse in the Type IV cleft palate patients who have had lip repair preceded by the insertion of a palatal bar, but not palatal repair. Here again it is evident that the dental arch collapse, as indicated by area measurements, is much less pronounced than that seen in the Type IV cleft palate patients operated upon elsewhere without use of a palatal bar.

Discussion

This study is in the nature of a progress report attempting to evaluate the effectiveness of the palatal bar in preventing dental arch collapse. Dental arch collapse appeared to be less pronounced in this small series of Type III and Type IV cases in whom palatal bars had been used than in the subjects in the reported study[7] in whom the bars were not used. The groups studied, however, were not equal. The cases in this study had no palatal surgery; the lip surgery was carried out by one plastic surgeon, and the dental study models were taken before age two, rather than after age seven. These factors must be taken into consideration in future studies.

It is well known that correction of dental arch collapse can be achieved if skilled orthodontic management is provided early enough. However, such treatment is unavailable to a large part of the cleft palate population. When available, it is prolonged and expensive. For this reason it is felt that any simple surgical measure which will prevent or even reduce deformity is well worth the time and effort necessary to its development. The long range objective of such studies is perhaps summarized best by Harvold:

"Throughout the world there is an increasing interest in a comprehensive and well organized treatment program for the cleft lip and palate child. But so far there has been no entirely satisfying form of organization providing an effective treatment for the average patient. Whether there is a socialized health scheme as in Scandinavia, or an independent medical and dental profession, as in the U.S.A., it seems difficult to finance the expensive treatment. Simpli-

fied and better methods of treatment are needed to achieve a satisfying therapy." 10, p. 307.

Conclusions

1. Dental arch collapse appears to be less pronounced in those patients whose palatal segments were supported at the time of lip surgery, and approximately four months thereafter, by a palatal bar.

2. Further investigation is indicated using groups which are better equated.

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