

# Five Years of Non-Operative Treatment of Scoliosis and Kyphosis—A Follow Up Study

by

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The non-operative treatment of scoliosis and kyphosis with the Milwaukee brace can be considered an unprecedented success of an orthotic technique.

We have known of spinal orthoses similar to the Milwaukee brace for a long period of time. However, the introduction of new fitting principles and team approach as advocated by the Doctors Schmidt, Blount, and Moe changed this appliance from a pas-

sive apparatus to a functional orthosis.

The basic concepts of the Milwaukee technique have been well disseminated. It is unfortunate that only a few clinics have reported on their experiences with this approach.

Our scoliosis clinic at Newington has seen a rapid growth since it was established five years ago. I would like to discuss our findings of clinical follow-up of 135 patients. We have applied more than 200 Milwaukee braces during the same period. My report is based on records of the scoliosis clinic at the Newington Children's Hos-

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pital and involves only cases treated with the Milwaukee brace.

Of these 135 patients 102 on their first visit were diagnosed as idiopathic scoliosis, 14 as juvenile scoliosis, 4 paralytic, and 15 as kyphosis. Other problems along with scoliosis and kyphosis were noted in 27 cases. They consisted of polio, muscular dystrophy,

neurofibromatosis, hemivertebra, amyotonia, spina bifida, syringomyelia, osteogenesis imperfecta, arthrogriposis, marphans syndrome and the Kippel Feil syndrome.

The following clinic basic routine was used for the treatment of these patients:

Initial medical work-up, basic evaluation and outline of treat-

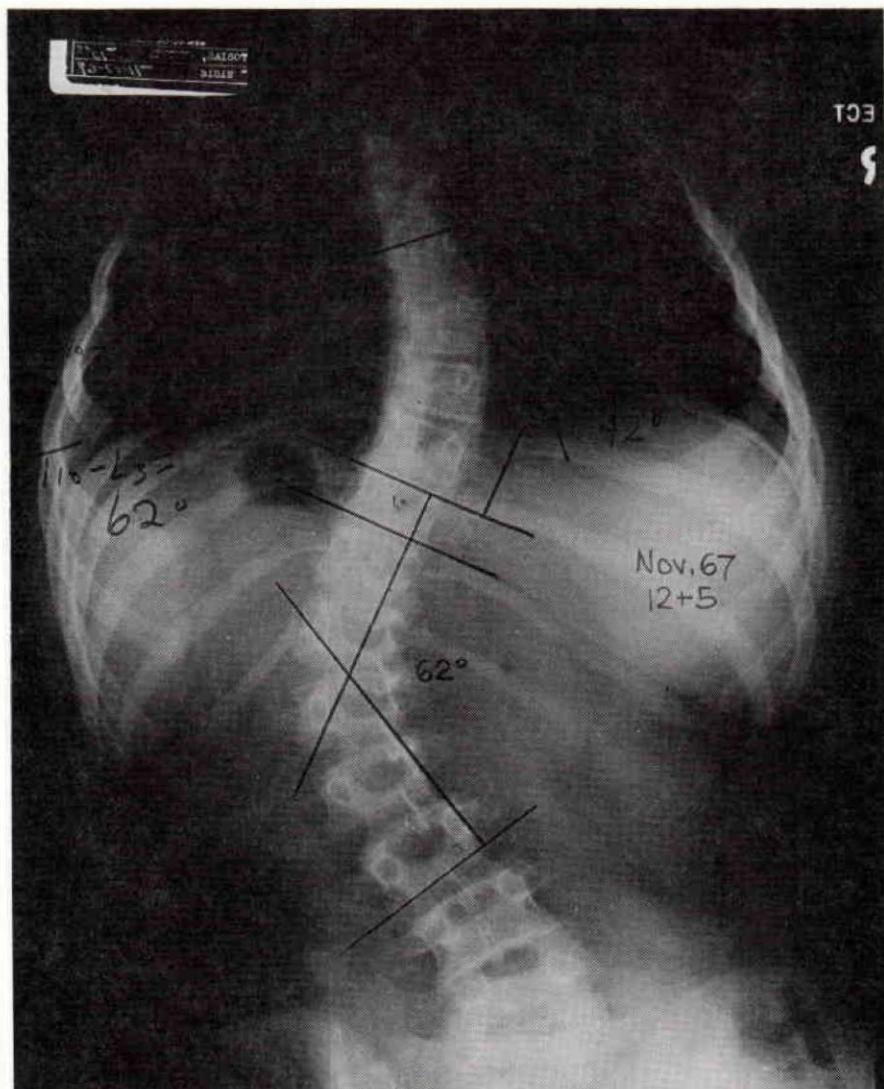


FIGURE 1—X-Ray of patient prior to application of localizer.

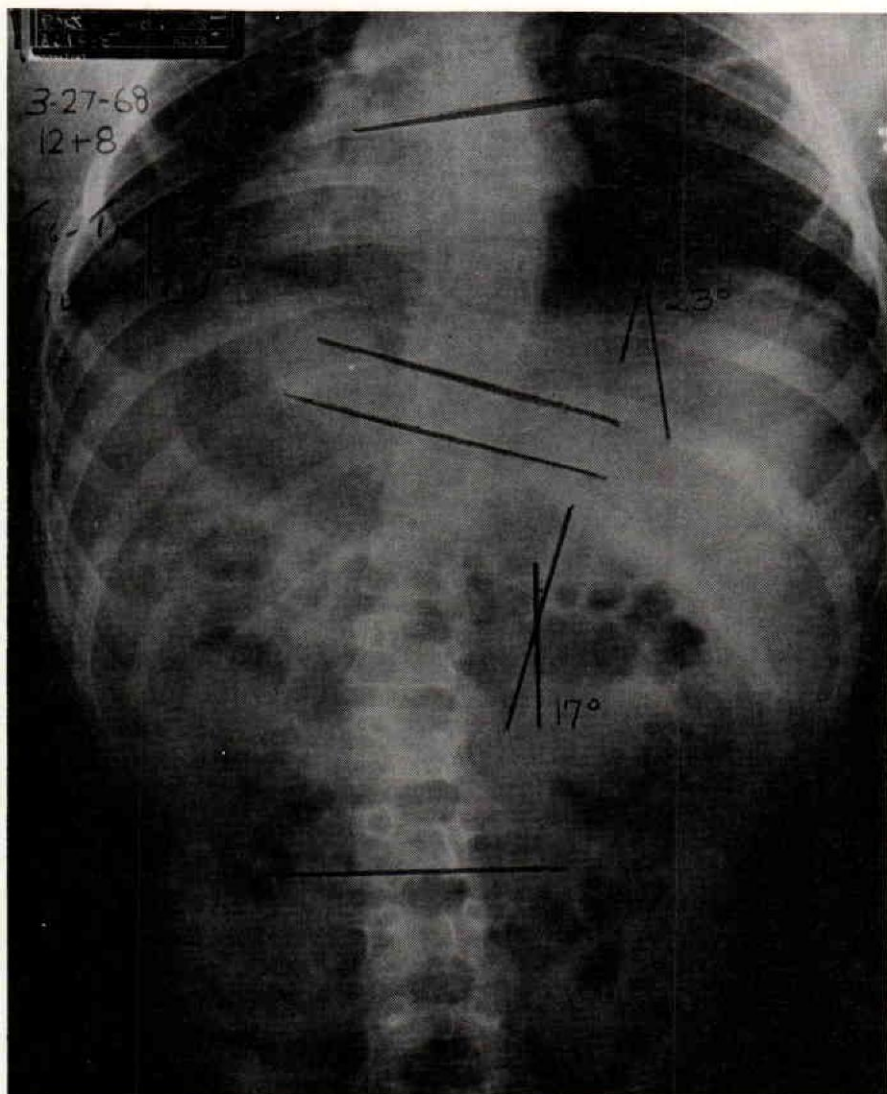


FIGURE 2—The same patient after application of localizer. Note excellent response.

ment, application of a localizer cast for cases with more than 45 degree curvature prior to brace application. A mold for the Milwaukee Brace was made at the same time the localizer was applied, along with impressions for retainers preventing malalignment of the teeth.

Patients wearing a localizer

would be re-admitted to the hospital after 4 to 6 weeks for removal of the cast and fitting and application of the brace and orientation of the patient.

X-rays had been taken of the patients after localizer application. New X-rays were made of all patients once the brace had been applied. The patient would receive



wearing instructions, physical therapy instructions and the retainer tested and delivered. The hospitalization which seldom ever exceeded one week, resulted in little or no loss of correction gained in the localizer, excellent brace tolerance and acceptance by the patient. It was also noted that psychological problems occurred far less frequently than reported by other clinics.

It is the patients' and parents' cooperation which is needed for a successful course of treatment. The patient returned to the Orthotic Department and the physical therapist one week after leaving the hospital for a review of the exercise routine and adjustments of the brace. It has been our experience, that we were able to achieve considerable correction at this early stage of treatment. The patient returned to the clinic every four to six weeks and would never be allowed to go longer than a maximum of eight to twelve weeks. He would be seen by the orthotist every six weeks for minor adjustments and maintenance of the brace. A localizer (Fig. 1 and 2) was applied or reapplied and the brace refitted if the course of treatment indicated no improvement.

Of the 135 cases studied only ten needed reapplication of a cast. However it should be of interest that (Fig. 3) 48 patients had been localized prior to brace application. It was necessary (Fig. 4) to have a refitting of the brace in 8 cases. Eighteen patients needed new pelvic sections and only 6 patients which had outgrown their

## APPLICATION OF LOCALIZER

### 48 PRIOR TO BRACING

### 10 REAPPLICATION POST BRACE APPLICATION

#### FIGURE 3

### REFITTING OR REPLACEMENT OF BRACE

#### 8 REFITTING

#### 18 NEW PELVIC SECTION

#### 6 REPLACEMENT OF ENTIRE BRACE

#### FIGURE 4

brace needed complete replacement during the five-year period.

The present outcome of the 135 patients treated demonstrates the excellent results of the Milwaukee brace treatment: (Fig. 5)

47 patients or 33% corrected to better than 20 degrees.

76 patients, or 56%, improved in the brace or were stabilized.

12 patients, or 11%, had fusions or application of Harrington Instrumentation after use of the brace for a period of time. This compares favorably to a study four years ago when 25% of the brace wearers had to be stabilized through surgery.

It should be of interest also that of the twelve patients who required surgical treatment, two had refused to wear the brace, and two patients had a paralytic scoliosis. Only short fusions with continuance of the brace had been performed in eight cases which had other findings secondary or primary to scoliosis.

The weaning process is the much anticipated moment of the brace patient. This process is carefully guided by our clinic and is pat-

**PRESENT OUTCOME of 135 PATIENTS TREATED at NCH**  
**with MILWAUKEE BRACE**

**47 - 33% CORRECTION BETTER THAN 20°**

**76 - 56% IMPROVED OR STABILIZED**

**12 - 11% OPERATIVE STABILIZATION**

**35      IN WEANING PROCESS**

**28      OUT OF BRACE**

**FIGURE 5**



**FIGURE 6—Hinged mandible and occipital section.**

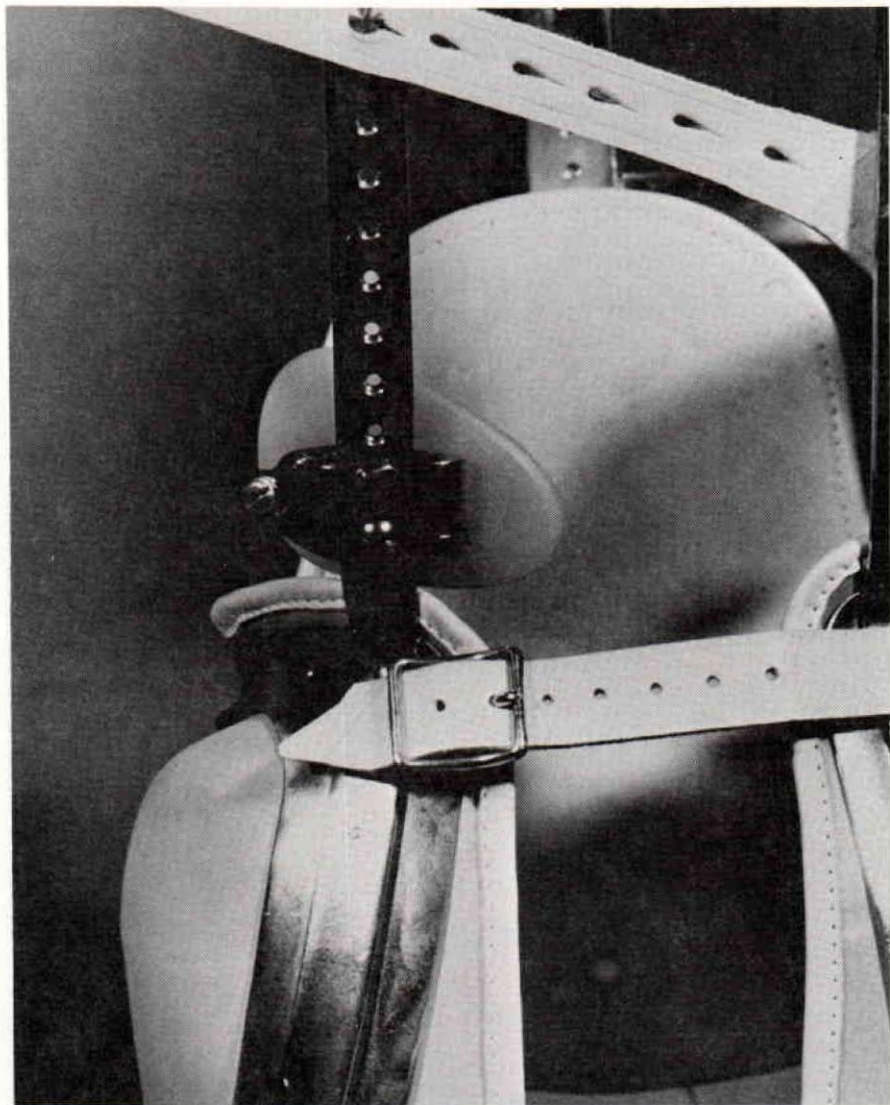
terned after the well-known outlines of the Doctors Blount, Schmidt, and Moe. At present we are weaning 35 patients from the brace and follow 28 which have successfully completed their treatment.

Considerable knowledge and experience has been gathered since the clinic was first established.

Experiences through solving problems resulted for us in deviations from the original approach which should be of particular interest to the orthotist.

Our first (Fig. 6) and oldest modification of the brace was hinging of the mandible section and the posterior uprights (Fig. 7) on their proximal point of attachment.





**FIGURE 7—Lumbar pad posterior view.**

Hinging of the neck ring enabled us to maintain an accurate fit of the entire head section after any adjustment and eliminated undue stresses caused by repeated bending of the uprights.

Major skin problems which occurred in particular during the summer were eliminated by treating the entire brace surface ex-

posed to the body with a heavy coating of a non-toxic acrylic. Our patients are now able to clean the entire brace with a damp cloth removing all of the perspiration deposits. It was found that skin reactions from the exposure to copper rivet oxide and the clogging of the pores by perspiration deposits had caused 90% of the



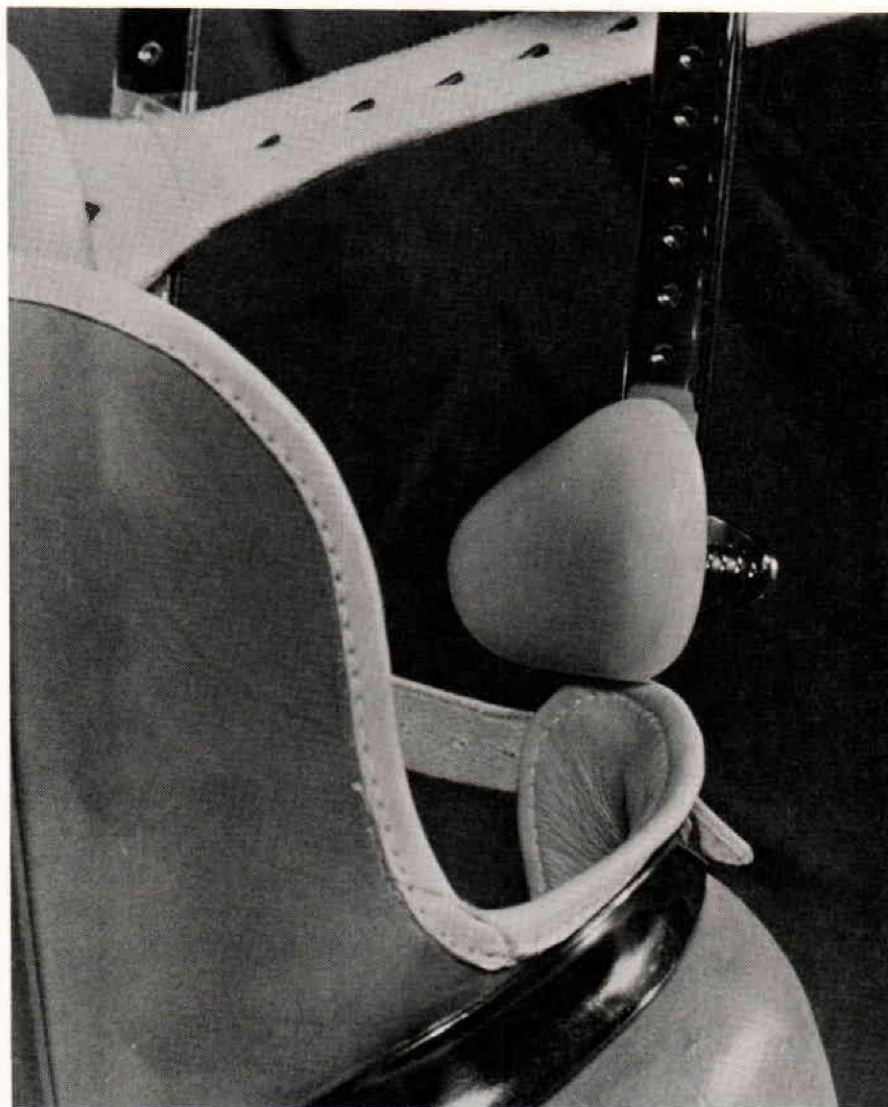
**FIGURE 8—Lumbar pad lateral view.**

skin irritations. The only breakdown of skin currently observed is the rare occasion of pressure over bony prominences. We definitely prefer to use leather, the organic material, over any other material for the pelvic section.

This does not hold true in the case of a lumbar pad developed by us. (Figs. 8, 9, 10, 11). This

spring-loaded hinged lumbar pad is made of Vitraethene, a polythene plastic, imported from England. Utilizing this skin-friendly plastic, which has a soap-like smooth surface for night splints and other orthotic appliances, made us aware of the non-adhering surface of this material. Difficulties were encountered with



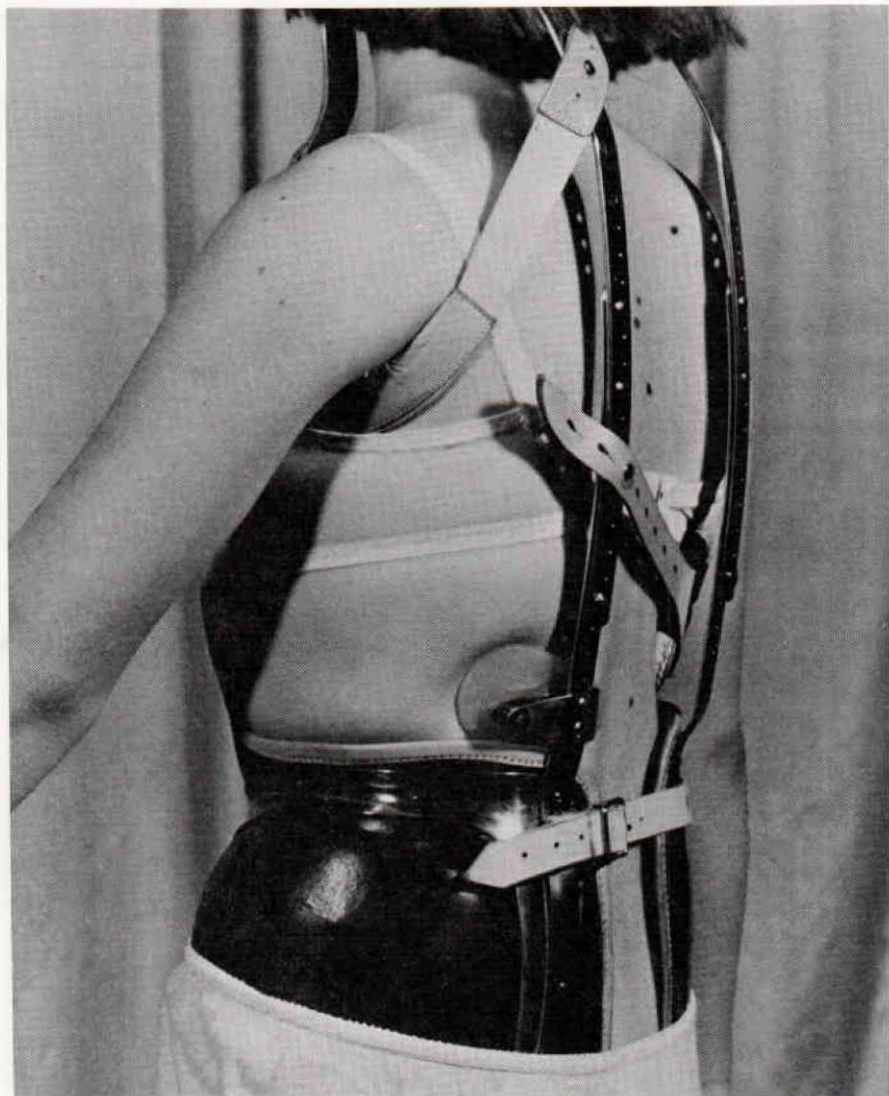


**FIGURE 9—Lumbar pad anterior view.**

the leather/aluminum combination of the original design attached by two straps. One on the anterior surface of the pelvic section looping through the same and the other on the opposing posterior bar. The new pad has been used for two years and many of the good results can be credited to this functional pad. (Fig. 12). The pad

is so located that its center is slightly below the apex of the lumbar curve. The center of the pad should be lateral to the transverse processes of the vertebra covered by the pad. The greatest force should be exerted on the lateral portion which should be worn as tight as possible, however, still enabling the





**FIGURE 10**—Patient wearing lumbar pad and new axilla sling.

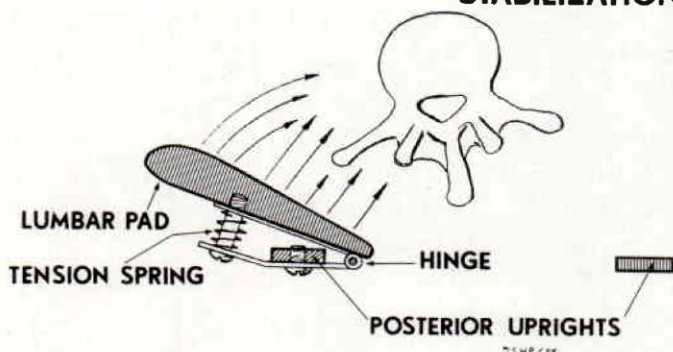
patient to pull away from the same.

We know today that the constant contact of the angular hinged and spring-loaded pressure pad has resulted in active lateral correction, derotation and excellent holding support. (Figs. 13, 14, 15). The triangular approach from a properly located

thoracic pad, a well fitted functional lumbar pad, and a contoured axilla sling will result in faster and more consistent results in the treatment of the typical scoliosis case.

Our most recent, and by our patients much appreciated, change is a contoured axilla sling. (Fig. 16). The previously worn straight

# **SPRING LOADED HINGED LUMBAR PAD** **FUNCTIONS:** **LATERAL CORRECTION** **DEROTATION** **STABILIZATION**



**FIGURE 11**

padded bar suspended by two straps was bulky and caused, especially in slightly obese cases, general discomfort and pressure on nerves and blood vessels located in the axilla. We borrowed the idea for improvement of the axilla bar from a fitting technique used for the harnessing of more difficult upper-extremity prostheses. The prosthetist is utilizing a "Hessing Axilla Pad" in cases of persistent soreness of the armpit.

The pad as we are using it today is made of well-contoured, padded leather with dacron straps. The pad is so designed that it provides relief for the tendons of pectoralis major and teres major. Its rather flat contour eliminates (Fig. 17) the pressure on nerves or blood vessels. The advantages of this design have enabled us to better balance the force applied through the thoracic pad and resulted in a superior static and dynamic alignment of

the brace besides a more comfortable fit.

Orthotists advocating the theory of a rigid bar for the axilla pad can reinforce this contoured pad by riveting a stainless steel plate on the leather surface prior to covering of the pad. It should be noted that the structural more firm and flat surface of the proximal lateral thorax will not lend itself to undesired changes as they could be observed at the lower rib cage level prior to application of a thoracic outrigger.

These modifications along with a follow up pattern of close supervision of the patient and the fit of the brace have enabled us to achieve the desirable end results presented today. The Milwaukee brace properly fitted and applied with good maintenance is without question the most effective conservative type of treatment of scoliosis and kyphosis known to us at this time.



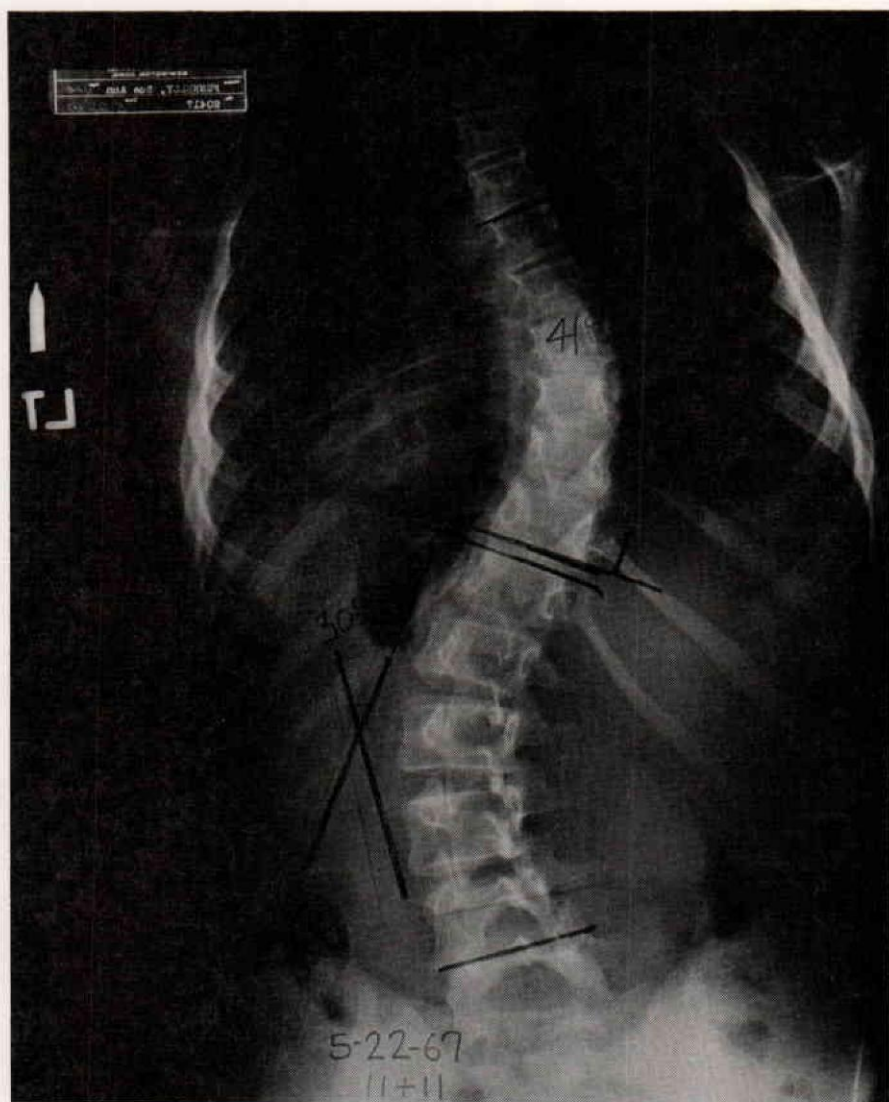


FIGURE 12—Patient prior to brace application. Note lumbar curve  $30^{\circ}$ , thoracic curve  $41^{\circ}$ .

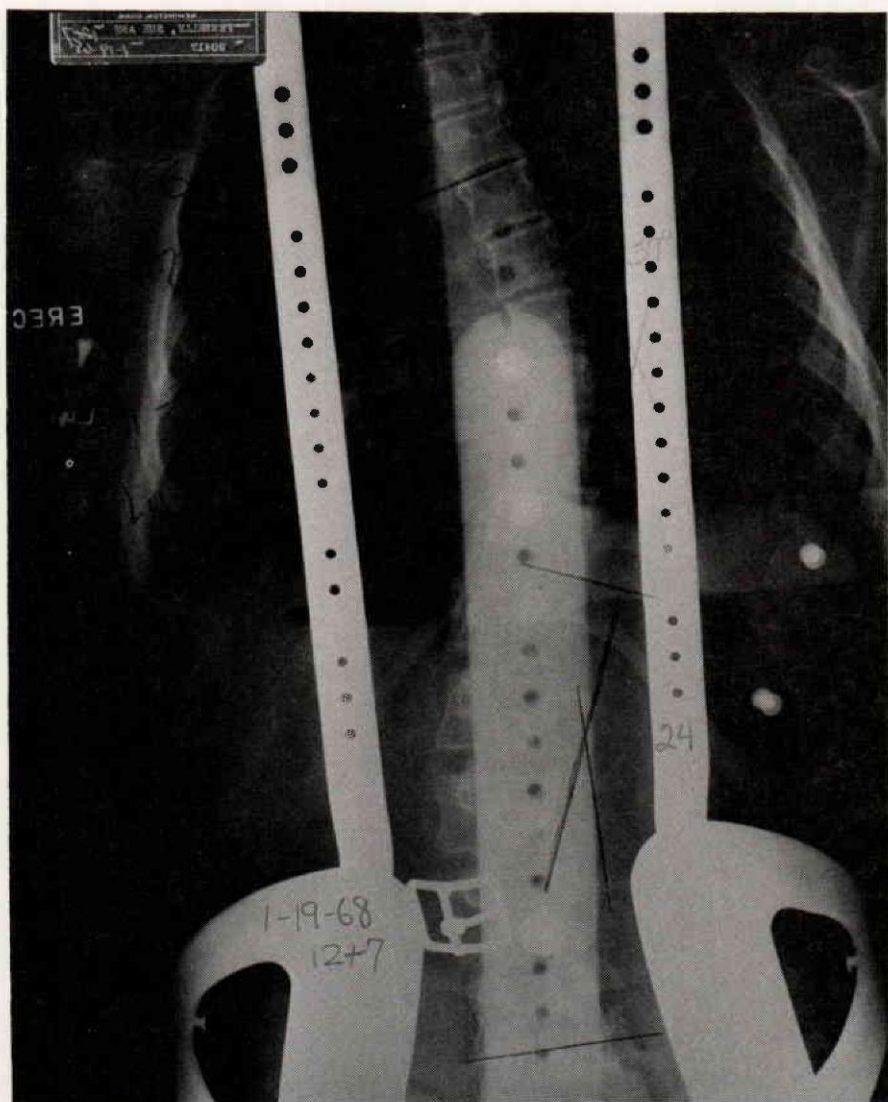


FIGURE 13—The same patient after 6 months in the brace. Note lumbar curve reduced to  $24^{\circ}$ , thoracic curve to  $37^{\circ}$ .



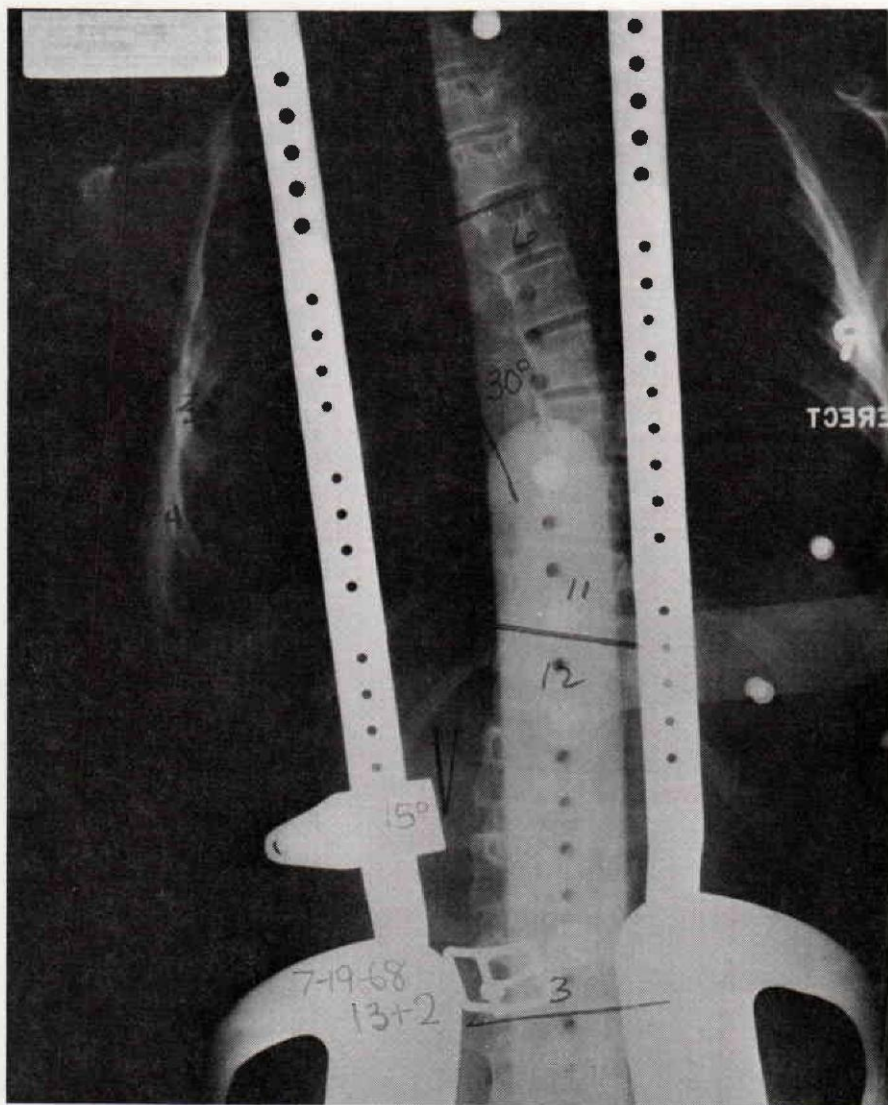
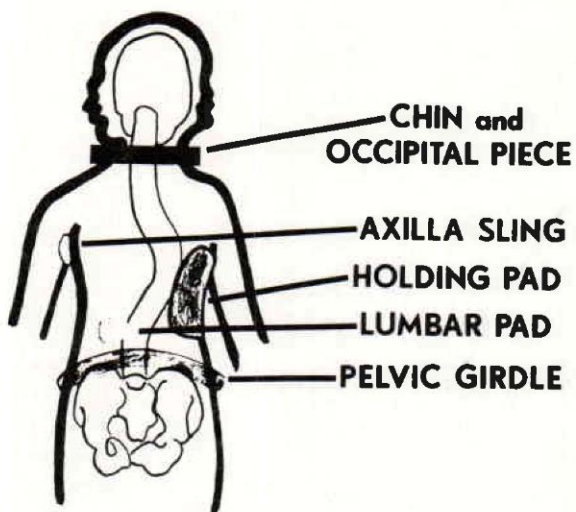


FIGURE 14—Patient after application of lumbar pad, length of wear 4 months. Note lumbar curve now  $15^{\circ}$ , thoracic curve  $30^{\circ}$ .



**AT REST**

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**ACTIVE DEROTATION**  
**LATERAL CORRECTION**  
**PASSIVE DISTRACTION**  
**STABILIZATION**

**FIGURE 15—Demonstration of bracing principle.**



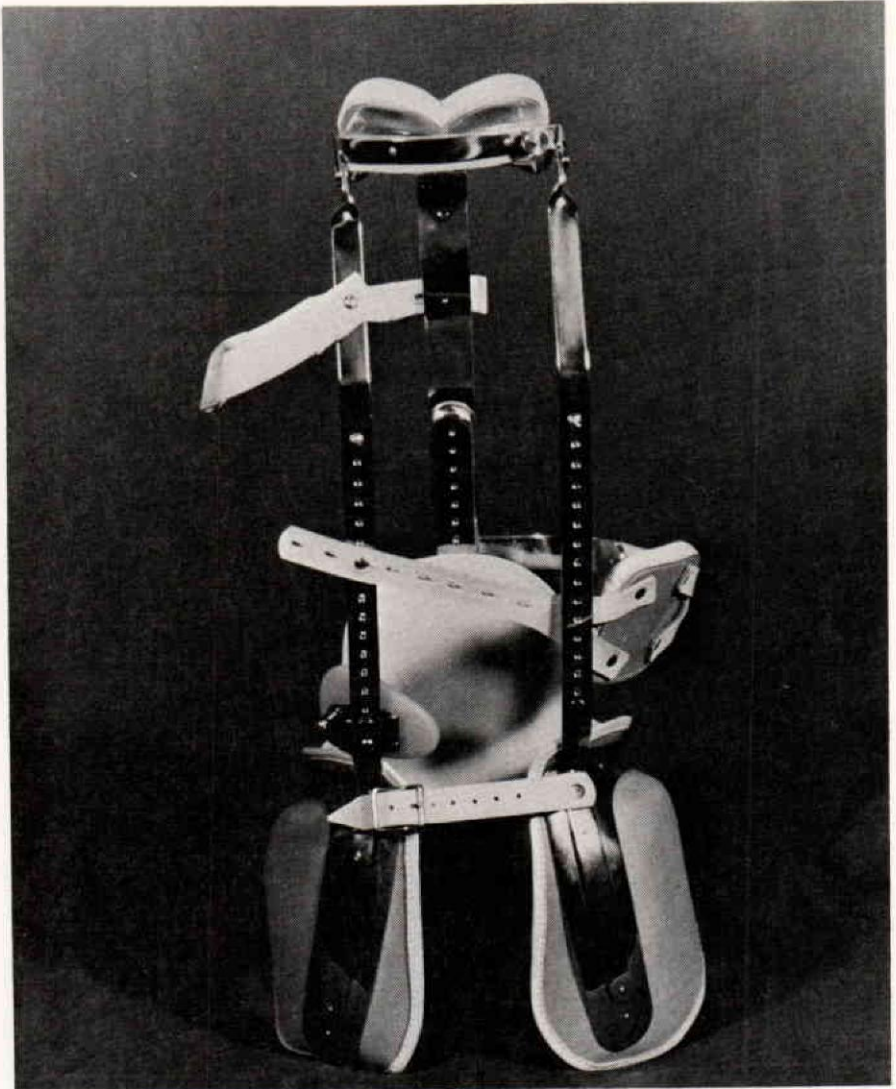


FIGURE 16—Contoured axilla sling, posterior view.

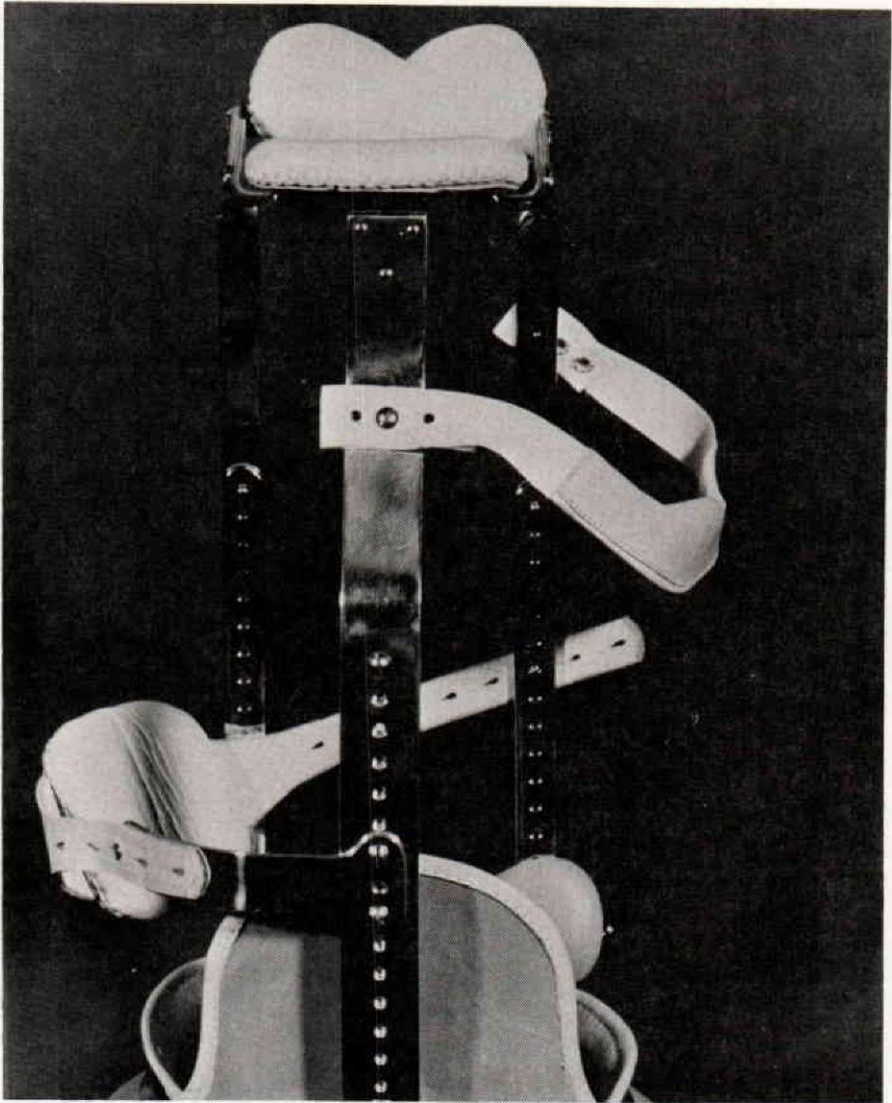


FIGURE 17—Contoured axilla sling, anterior view.

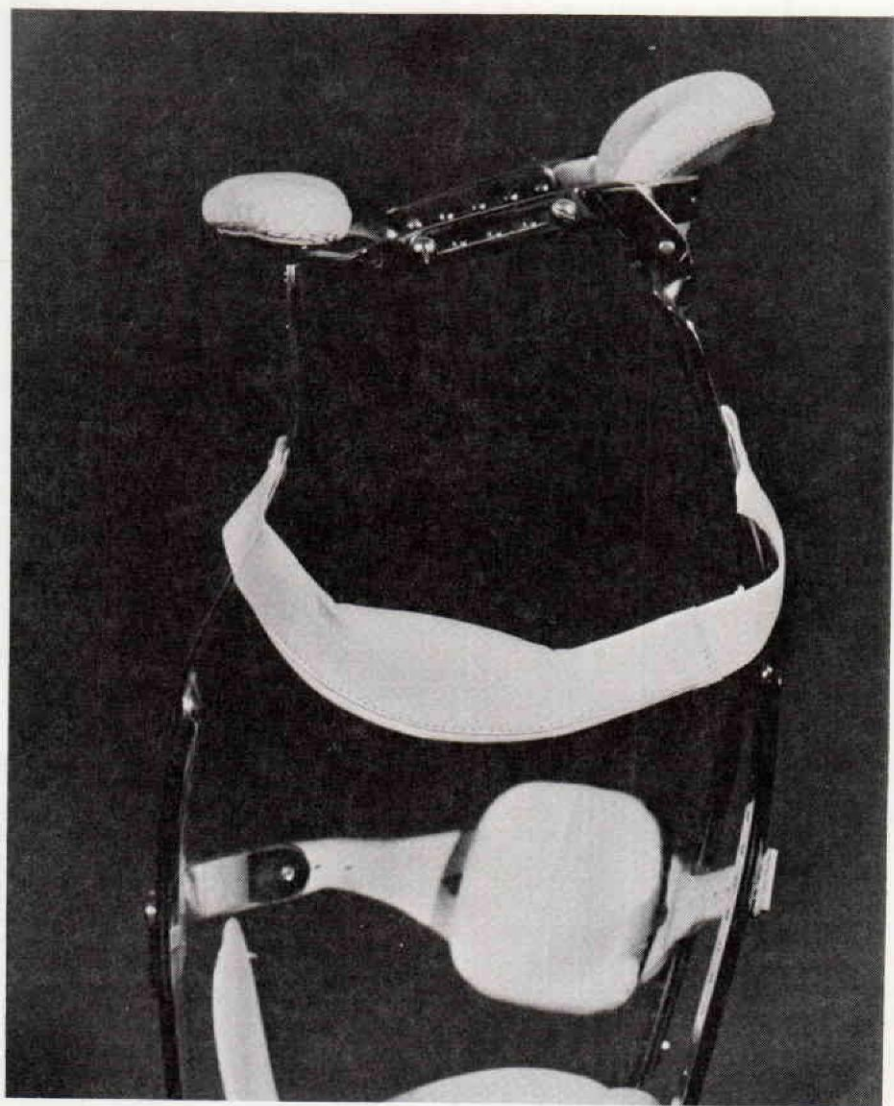


FIGURE 18—Contoured axilla sling, lateral view.



Cosmesis is of greatest importance to our patients and elimination of protruding ribs, winging of the scapula, pelvic tilt and rotation of the shoulder girdle can be considered important results, even though a curvature is present.

Our clinic is presently applying the brace in cases which at one time were considered for surgical treatment only. This type of treatment demonstrates once again the effectiveness of the more and more practiced team effort.

## ACKNOWLEDGEMENTS

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