Evaluation of Underarm Plastic Spinal Orthosis in Management of Scoliosis

RATNESH KUMAR, U. K. JAIN, A. K. AGARWAL & V. P. SHARMA

INTRODUCTION

Spinal bracing is known since prehistoric era. During last few decades, introduction of plastic, better understanding of biomechanics of spine & coordinated approach of medical and engineering has revolutionised the conservative modalities for scoliosis management. Milwaukee brace popularised spinal orthotic and later replaced by Boston brace due to its high acceptability. Due to high prevalance of Poliomyelitis, paralytic scoliosis as childhood disability is common in India. The massive involvement of limbs and trunk muscles has put restrictions to the surgical management. These cases require early spinal bracing. The changing social norms besides cost factor & high skill required in fabrication of Milwaukee brace, opened further the chapter of plastic spinal orthosis (UPSO). In India, plastic has come in use for orthotic recently. In northern India, we have used it first time in conservative management of scoliosis. The present study was planned to evaluate the effectiveness, acceptability & long term effects of UPSO in growing scoliotic patients.

MATERIAL AND METHOD

Skeletally immature patients of scoliosis irrespective of age, sex & aetiology, who attended department of Ortho. Surgery and Physical Medicine & Rehabilitation, King George's Medical College, Lucknow were included in the study. They were clinically & radiologically evaluated as per proforma based on the data card published by the Scoliosis Research Society of United States for initial recording & follow up. Curve was measured by Cobb's method (1948). While Nash & Moe Index (1969) was used to find out the rotation of the apical vertebra.

Prerequisite for UPSO—

—Patient should be skeletally immature.
—Apex of curve should be at or below T7 vertebra.
—Curve should be flexible.
—Pulmonary functions should be within normal limit.
—There should be no congenital unsegmented unilateral bar.
—Patient & family should be cooperative.

Fabrication of UPSO

A negative POP mould of TLSO was taken on Risser's localizer casting table by applying head haulter & pelvic traction. The extent of POP cast was superiorly from manubrium sterni anterior, axillary fold laterally & cervicothoracic junction posteriorly, to greater trochanter, pubic symphysis & coccyx inferiorly. Positive mould was further modified to relieve, pressure points & to provide proper corrective forces. A thermoplast sheet of proper size was moulded on POP positive cast. Trimming of

[1]Medical Officer, District Rehabilitation Centre, Sitapur.
[2]Prof. of Orthopaedic surgery, K. G. Medical College, Lucknow.
[3]Sr. Med. Officer cum Reader, Dept. of Physical Medicine and Rehabilitation, RALC, K. G. Medical College, Lucknow.
[4]Lect., Dept. of Phy. Med & Rehab. RALC, K. G. Medical College, Lucknow.

plastic mould followed by proper padding & adhesive strapes were fixed. For ventillation, additional punched holes were made. Skiagram, pre-POP cast, in POP cast & in brace, were taken. During the use of brace, chest & spinal exercises were explained to the patients. The patients were followed up clinico-radiologically at periodic interval. In brace & out of brace skiagrams were taken in follow up visits besides clinical examination.

OBSERVATION

45 cases of scoliosis of varied aetiology, age & sex etc. were studied & presented here in subsequent tables.

Table I. Distribution of scoliosis cases in relation to aetiological type and sex

Aetiological type	Male	Female	Total
Congenital	3	6	9
Idiopathic	9	9	18
Paralytic	12	6	18
Total	24	21	45

Among the studied cases, 53.3% were males & 46.7% females. 20% cases were of congenital type followed by 40% in idiopathic & paralytic type each. In idiopathic, male & female distribution was equal, where as females were representing 2/3rd of cases in paralytic group.

Table II. Distribution of cases in relation to aetiological type and age

Aetiological type	Age group (years)				
	0-4	5-9	10-14	15-17	Total
Congenital	4	2	3	—	9
Idiopathic	—	3	10	5	18
Paralytic	2	9	5	2	18
Total	6	14	18	7	45

Cases were of varied age-ranging from 18 months to 17 years. Majority of scoliosis cases (18) were in the age group '10-14 years' followed by age group '5-9 years' (14). 50% cases of paralytic group were in the age of 5-9 years, whereas 55.5% idiopathic cases were in the age group of '10-14 years'.

Table III. Scoliosis cases and curve pattern

Aetiological type	Dorsal	Dorso-Lumbar	Lumbar	Double	Total
Congenital	1	5	1	2	9
Idiopathic	4	11	—	3	18
Paralytic	2	16	—	—	18
Total	7	32	1	5	45

Five cases were having double curve, thus making it a total of 50 curves in 45 cases. Dorsolumbar curve (32) was found to be commonest. Double curves were found in congenital (2) & idiopathic (3) cases.

Table IV. Aetiological type and severity of deformity

Severity of curve (in degree)	Congenital (C)	Idiopathic (I)	Paralytic (P)	Total
Less than 25°	1	—	1	2
26-45	4	10	8	22
46-65	5	9	4	18
66-85	1	2	3	6
86 & above	—	—	2	2
Total	11	21	18	50

All cases (except two) were having curve more than 25°. Majority of curves (44%) were of '26-45 degree' severity, followed by 18 curves in '46-65 degree'. Two cases were having curve more than 86°.

Flexibility of curve has been calculated by the following formula (Winter R.B. et al. 1974).

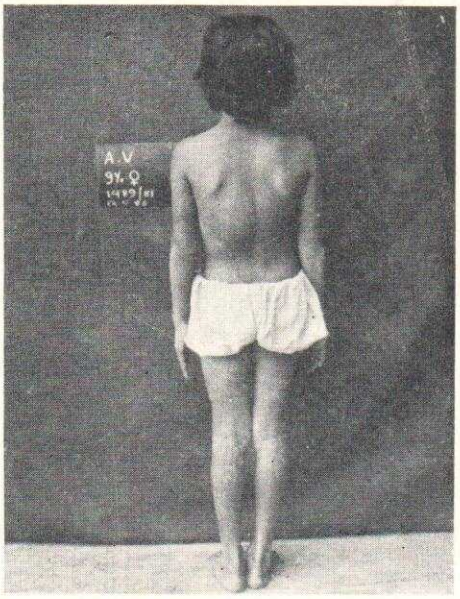

Fig. 1A. A. V., 8 years, a case of Congenital Scoliosis.

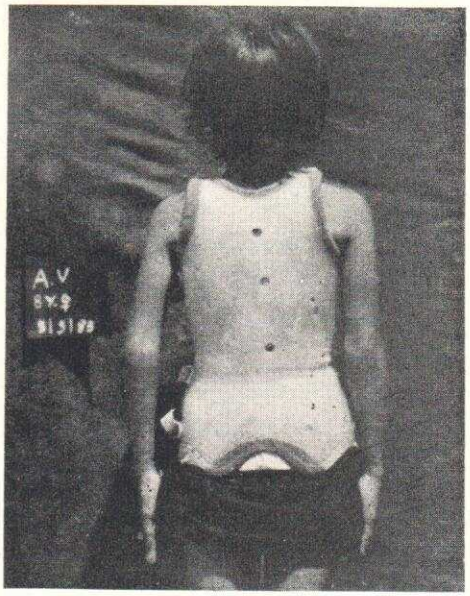

Fig. 1B. Same case with Brace.

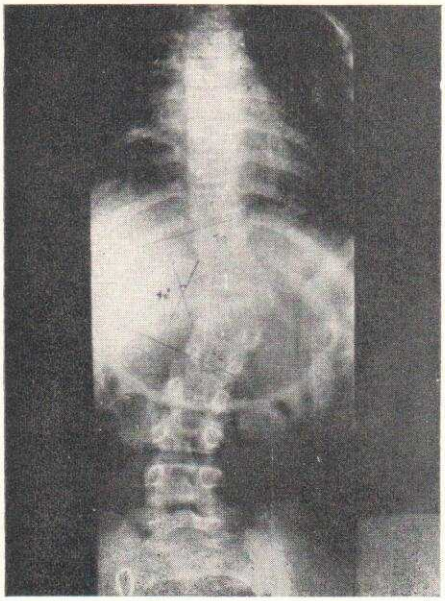

Fig. 1C. Pre-Brace Cobb's Angle 40°.

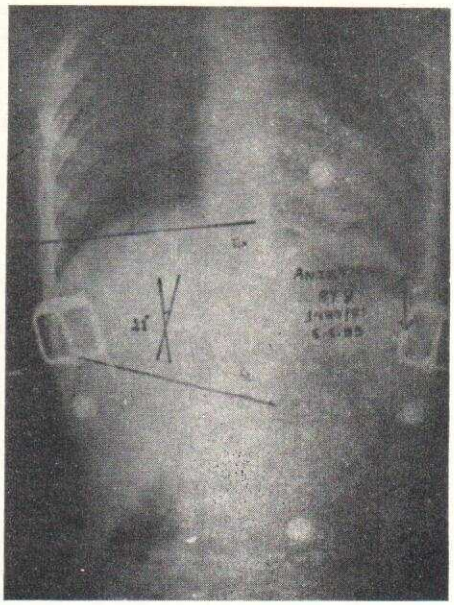

Fig. 1D. Same case with Brace, Cobb's Angle 22°.

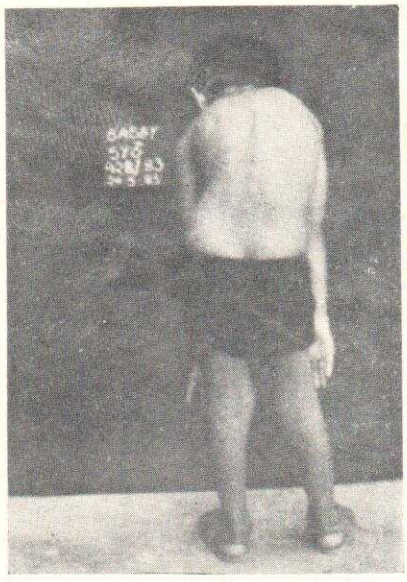

Fig. 2A. Baby 5 years, a case of Paralytic Dorso-Lumbar Scoliosis.

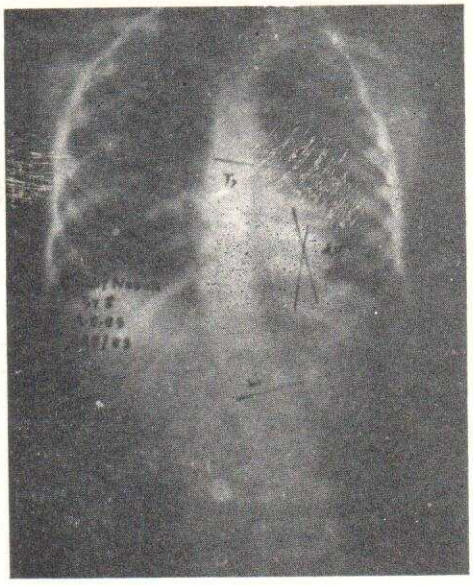

Fig. 2B. Pre-Brace Cobb's Angle 25°.

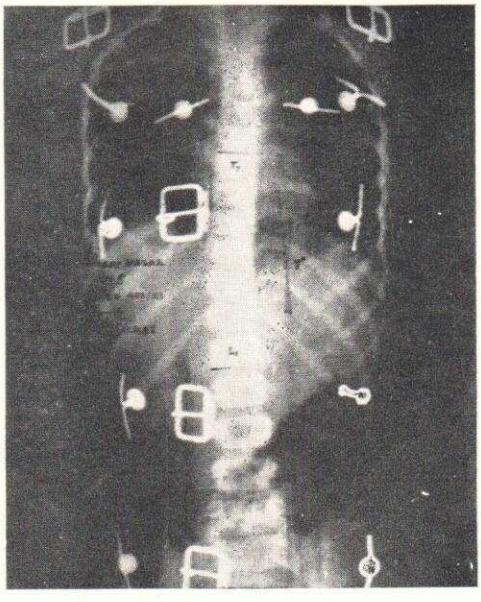

Fig. 2C. Same case with Brace, Cobb's Angle 7°.

Fig. 3A. Shama 12 years, a case of Idiopathic Dorso-Lumbar Scoliosis.

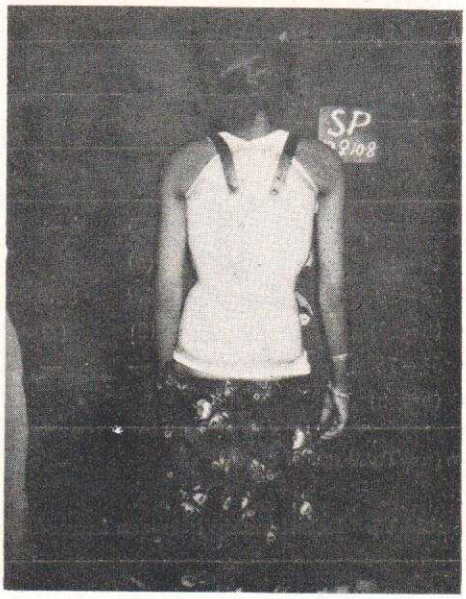

Fig. 3B. Same case with Brace.

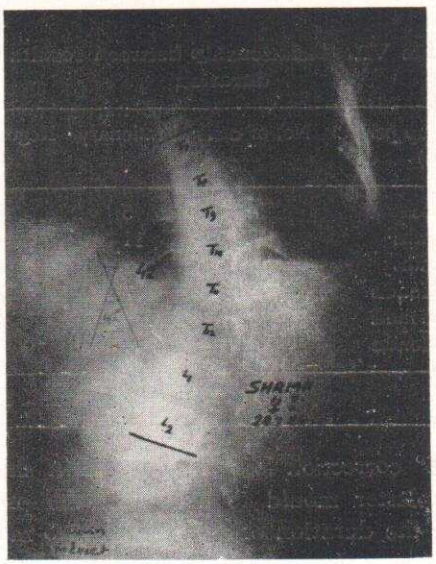

Fig. 3C. Pre-Brace Cobb's Angle 42°.

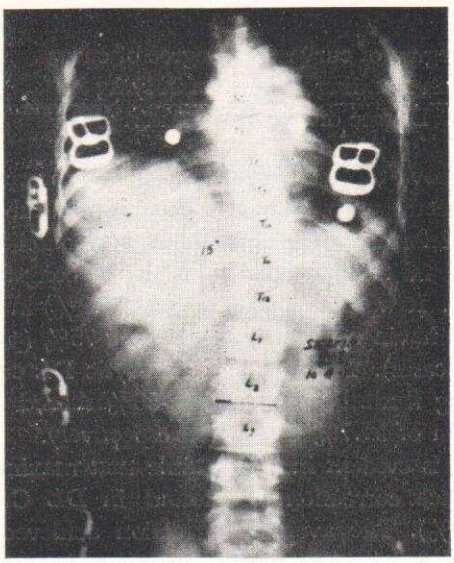

Fig. 3D. Same case with Brace, Cobb's Angle 15°.

Table V. Relationship between flexibility of curve and in-brace correction (immediate)

Flexibility of curve (%) / Mean correction	Mean Correction									Average correction (%)
	Dorsal curve			Dorso-lumbar			lumbar curve			
	C	I	P	C	I	P	C	I	P	
Less than 25	11.6	32.5	—	39.8	35.4	47.9	36.6	—	—	34
(n=27)	(1)	(5)		(7)	(7)	(4)	(3)			
26—50	—	44.2	38.6	—	57.7	57.3	—	—	—	48
(n=20)		(2)	(2)	—	(7)	(9)				
51—75	—	—	—	—	—	72	—	—	—	72
(n= 3)						(3)				

(n=Total no. of curve)

Table VI. Relationship between immediate correction achieved in relation to severity of curve

Curve pattern	No. of curve	Mean correction in curve less than 40°(%)	Mean correction in curve more than 41°(%)	Average correction (%)
Dorsal (D)	10	50.8	24.0	37.4
Dorso—Lumbar (DL)	37	44.0	47.5	45.8
Lumbar (L)	3	38.9	32.0	35.5

$$= \frac{\text{Degree of curve in standing} - \text{Degree of curve in lying}}{\text{Degree of curve in standing}} \times 100$$

Above table shows that in-brace correction is directly proportional to flexibility nature of the deformity. The minimum correction was noted in the partially rigid dorsal congenital curve. It was maximum (average 72%) in DL curve having flexibility between 50-75% (paralytic cases). Idiopathic & paralytic DL curve having flexibility between 26-50% shared correction of 51.7% & 57.3% respectively.

It is evident in above table that maximum in-brace correction was found in DL Curve (45.8%). The average correction achieved in dorsal & lumbar curve was found to be practically same 37.4% & 35.5% respectively.

Table VII. Relationship between results & duration

Follow-up period (months)	No. of cases	Stationary	Regressed
3 Months	5	5	—
4-6 Months	11	11	—
7-9 Months	6	2	4
10-12 Months	11	7	4
13-15 Months	6	4	2
16-20 Months	6	4	2
Total	45	33	12

2-6° correction loss was noticed in shifting from plaster mould to brace. In the present study, the duration of deformity was 5 months to 12 years. In most of cases (24), it was 1-6 years. Cases were followed clinico-radiologically

at three monthly interval. Maximum follow up was of a 20 months whereas minimum was of 3 months only in 5 cases. In 33 cases curve was stationary, whereas there was regression (out brace) in 12 cases. Majority of cases (41) were using brace 20-23 hours daily as per instructions given, except one who was irregular & there was no drop out.

Table VIII. Complications

Discomfort	.. 3
Heat (subjectively)	.. 5
Skin rash	.. 2
Cycling problem	.. 1
Social problem (cosmetic)	.. 1

Continuous use of brace (except one) itself is indicative of absence of any significant complication. The commonest problem noticed by patients (5) was of feeling of warmth. 3 cases had mild discomfort but exact nature could not be explained by them. Two cases reported mild skin rashes which were insignificant. One case reported social problem of cosmetic nature. None of case reported functional or physiological hinderance.

DISCUSSION

In the present study, under arm plastic orthosis was used as a modality of conservative management of scoliosis. All the cases, except one, were in growing skeletal stage. In contrast to the observation of Hall J. (1975), Walt H. G. (1977) & Bunnel, W. P. (1980) who selected curve of 25 to 28° only. In the present series, the increased deformity (more than 40° in 56% cases) at the time of first attendance might be due to lack of awareness of complication of spinal deformity & also due to full coverage of the back in females, thus deformities were noticed very late in our society.

In this study DL curve was commonest (71.1%) followed by dorsal curve, similar to findings of Bunnel, B. P. et al. (1977) & Walt H. G. et al. (1977). Park J. et al. (1977) recorded higher incidence (53%) of lumbar curve & Hall J. et al. (1975) reported dorsal curve in 31% cases. In idiopathic cases we found double curve in 16.6% cases against the observation of Hall J. et al., Walt H. G. (1977) & Bunnel W. P. et al. (1977) who reported in 28 to 31%. The difference could be due to variation in geographical area. According to Carr W. A. et al. (1980) long term results of brace treatment can be predicted by response of curve to brace during first year of treatment. Maximum correction (72%) was observed in patient's-curve having flexibility of 50-75%, followed by 48% correction in cases with flexibility of 25-50%. A mean correction of 34% was observed in lesser flexible curve (25%). Immediate correction was found to be directly proportional to flexibility of curve, irrespective to aetiology. This observation was similar to Winner, R. B. & Moe, J. H. (1974). 47 out of 50 curve were having flexibility less than 50%, hence the correction achieved was less than 50%. In these cases significant correction can be expected (Carr, W. A. et al., 1980).

In our series from POP to brace shift, the average loss of angle was 5°, similar to those of Bunnel, W. P. et al. (1980). Patient having dorso-lumbar curve responded best (45.8%) amongst the patient with different curve pattern. It is similar to observation of other workers. Since there were only two lumbar curve, no inference could be drawn for lesser correction achieved.

Cases were followed up for up to 20 months, curve showed regression in 30% & stationary in remaining 70% cases. Cases (29) who used brace for more than 6 months, curve was stationary in 58.6% & regression in 41.4% cases. The cases are still under brace treatment & weaning has yet to be started. Our results are satisfactory similar to Park J. et al. (1977), who showed satisfactory results in 80% cases during 36 months follow up.

In the present study, 8 cases had reported problems during use of brace. Subjective feeling of warmth by five cases in brace was similar to observation of Bunnel, W. P. (1980). This problem was further minimised by making multiple punched out holes in the brace. We recorded mild discomfort in 6-7% cases against 21% reported by Walt, W. P. et al. (1977). Various mild skin reactions as hyperemia, blistering & skin rash were reported ranging from 5-38% cases by Walt, H. G. et al. (1977), Hall, J. et al. (1975), Bunnel W. P. et al. (1980). We noticed mild skin rash in 4.5% cases only. No treatment was required. This could be due to different material used by various authors besides changed climatic condition & body resistance in Indian population.

We found high acceptability of brace similar to Walt, H. G. et al. (1977), Park J. et al. (1977) and Bunnel, B. P. et al. (1980). The female patients reported cosmetic & social problem, which was minimised by modifications in their clothings.

REFERENCES

1. **American Academy of orthopaedic surgeons, Atlas of Orthotic, C. V.,** Mosby Company St. Louis, 1975.
2. **Bunnel W. P. and Moe Ewen GD,** Use of the orthoplast Jacket in the non operative treatment of scoliosis J. Bone Joint Surg. 62 A, 62-1, 31-38, 1980.
3. **Cobb J. R.,** Outline for the study of scoliosis instructional course lecture, Edited by J. W. Edwards Ann. Arboi, Michigan American Academy of Orthopaedic surgeons, 1948.
4. **Hall J. Miller W., Shumann W. and Stanish W. A.,** A refined concept in the orthotic management of scoliosis. Orthot. Prosth. 29, 9-16, 1975.
5. **Nash C. L. & Moe J. H.,** A study of vertebral rotation J. Bone Joint Surg. 51 A, 223-229, 1969.
6. **Park J., Houtkins, Grossman J. and Lavine D. B.,** A modified brace (Prenyl) for scoliosis. Clin. Orthop. 126, 67-73, 1977.
7. **Watt H. G., Hall J. E. and Stanish W.,** The Boston brace system for the treatment of low thoracic and Lumbar scoliosis by the use of a girdle without superstructure, Clin. Orthop, 126, 87-92, 1977.
8. **Winter R. B. and Loveli W. W.,** Orthotics for spinal deformity. Clin. Orthop, 102, 72-91, 1974.