

Research Article

Successful Brace Treatment of Scheuermann's Kyphosis in Skeletally Mature Patients and Severe Kyphosis

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Abstract

Background: In the last 20 years, there have been no reports on bracing for Scheuermann's kyphosis with 2-year follow-up. The purpose of this study was to retrospectively review patients treated with a thoracolumbosacral orthosis (TLSO) with greater than 2-year follow-up.

Methods: 126 patients treated at a single center with Scheuermann's kyphosis were reviewed. Inclusion criteria included the diagnosis of Scheuermann's kyphosis, treatment with TLSO and a minimum of 2-yr follow-up. Charts and radiographs were reviewed. Worsening or improvement of deformity was defined as a radiographic change of greater than 5 degrees.

Results: 12 patients met the inclusion criteria. Overall 8/12(67%) improved and 4 of the 8 patients (50%) who improved were skeletally mature at the time of brace treatment initiation. Of the 5 patients with curves greater than 70 degrees, 3 remained unchanged, 2 of these improved, and none progressed. The average improvement in kyphosis was 11 degrees in this group. Of the 7 patients with curves less than 70 degrees, 1 worsened and 6 improved; the average improvement in kyphosis was 7 degrees.

Conclusions: In this study, improvement of kyphotic deformity was observed in patients regardless of skeletal maturity and initial severity of kyphosis. These results suggest that a trial of brace treatment may be warranted even in patients that have severe kyphosis or are skeletally mature.

INTRODUCTION

Scheuermann's Kyphosis is the most common cause of structural thoracic or thoracolumbar hyperkyphosis in adolescents with a reported incidence of 0.4% to 8% [1-3]. Treatment options for this disease include physiotherapy, bracing, and surgical treatment. Both the Milwaukee brace (cervical thoracolumbosacral orthosis- CTLSO) and Thoracolumbosacral orthosis (TLSO) have been used to treat Scheuermann's kyphosis. Bracing with the Milwaukee brace has been supported by the studies of Bradford *et al.* demonstrating its efficacy in improving kyphosis [4]. Gutowski and Renshaw compared the Milwaukee brace to a TLSO for treatment of Scheuermann's Kyphosis and juvenile roundback [5]. In their study, the Milwaukee brace had better correction in compliant patients than those treated with a Boston TLSO-type brace, but they also found that the Milwaukee

brace patients were half as likely to be compliant as the Boston brace patients [5]. They concluded that the Boston brace is an acceptable alternative for flexible curves less than 70 degrees. Based on the lack of compliance with the Milwaukee brace, we have used an antikyphosis TLSO as our standard orthotic regardless of curve magnitude (Figure 1A and 1B). The purpose of this study was to retrospectively review patients treated at our institution with this TLSO (thoracolumbosacral orthosis) with greater than 2-year follow-up.

MATERIALS AND METHODS

We performed a retrospective review of all patients diagnosed with Scheuermann's Kyphosis at a single institution from 1989 to 2010. Institutional review board approval was obtained. The diagnosis of Scheuermann's Kyphosis was made based on a

kyphosis of greater than 45 degrees and consecutive anterior wedging of greater than 5 degrees in three consecutive vertebrae [6]. Patients who were initially treated operatively or who were unable to tolerate initiation of brace treatment were excluded. Charts and radiographs were reviewed of 126 consecutive patients with Scheuermann's kyphosis and 12 patients met the inclusion criteria and comprise this study group (Figure 2).

Worsening of the kyphotic deformity was defined as an increase in kyphosis greater than 5 degrees. Improvement was defined as a decrease in kyphosis greater than 5 degrees. Patients were considered skeletally mature if their Risser score was a 4 or 5.

RESULTS

There were 12 patients who met the inclusion criteria and comprised the study group. Average age of patients upon presentation was 13.5 years (range, 10 to 17). All 12 subjects were males. None of these patients had a scoliosis of greater than 10 degrees. None of these patients had any weakness detected on neurologic exam. The mean length of follow-up was 34.3 months (range, 24 to 53) with a mean length of brace therapy of 20.7 months (range, 9 to 42).

The mean initial kyphosis of all subjects was 71 degrees (range, 58 to 108). 8 of the 12 subjects (67%) had improvement of their kyphotic deformity, 3 subjects (25%) had no change, and 1 subject had worsening of the kyphosis (figures 3 and 4). 4 patients were skeletally mature at the time of brace treatment initiation and all 4 of these patients experienced an improvement with brace therapy, with a mean decrease in kyphosis of 9 degrees (range, 6 to 13).

There were 5 subjects with an initial kyphosis greater than 70 degrees and of these, 3 remained unchanged, and 2 subjects improved with bracing therapy. The two subjects that improved had improvements of 17 degrees and 31 degrees, for a post treatment kyphosis of 55 and 77 degrees, respectively. 7 patients had kyphosis of less than 70 degrees and of these, 1 (14%)

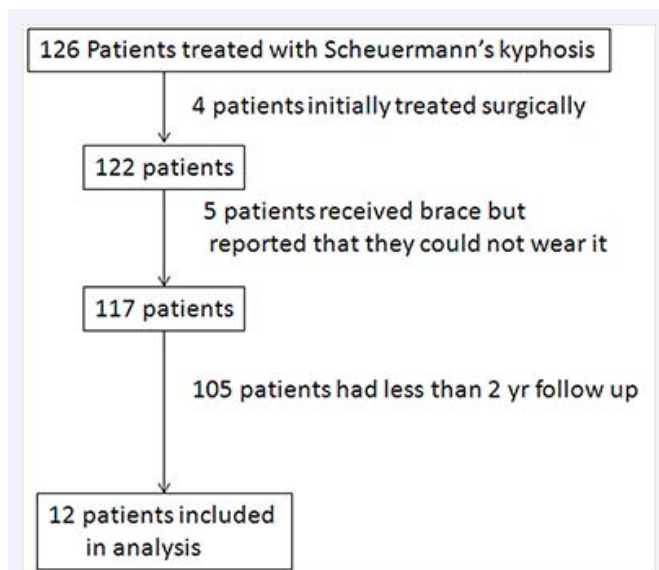


Figure 2 Flow diagram of the patients who were initially reviewed and their reasons for exclusion from this study.

Scheuermann's Kyphosis Patients that improved with TLSO brace treatment

Subject	Age of Initial Evaluation (years)	Skeletally mature (risser4/5)	Pretreatment Kyphosis (degrees)	Posttreatment Kyphosis (degrees)	Improvement in Kyphosis (degrees)	Duration of brace wear (mo)	Length of Followup (mo)
1	14	N	67	57	10	23	32
2	14	N	80	63	17	21	24
3	14	Y	62	55	7	12	24
4	15	N	108	77	31	16	28
5	17	Y	61	55	6	12	30
6	10	N	59	49	10	24	35
7	13	Y	62	49	13	30	36
8	14	Y	58	47	11	42	53

Figure 3 Table of the patients who had improvement in their kyphotic deformity with TLSO brace treatment.



Figure 1 Photo of standard antikyphosis TLSO used at our institution from the front (A) and side (B) views.

Scheuermann's Kyphosis Patients that did not improve with TLSO brace treatment

Subject	Age of Initial Evaluation (years)	Skeletally mature (risser4/5)	Pretreatment Kyphosis (degrees)	Post treatment Kyphosis (degrees)	Improvement in Kyphosis (degrees)	Duration of brace wear (mo)	Length of Followup (mo)
1	13	N	65	73	-8	26	37
2	11	N	74	72	2	20	43
3	14	N	73	70	3	9	29
4	13	N	83	83	0	13	40

Figure 4 Table of the patients who did not have improvement in their kyphotic deformity with TLSO brace treatment.

worsened and 6 (86%) improved. Of the curves less than 70 degrees, the average improvement was 9.5 degrees (range, 6 to 13) after 30.5 months (range, 13-53). The patient who worsened had a kyphosis of less than 70 degrees which worsened 8 degrees after 30 months of TLSO bracing therapy.

There were 2 patients that underwent posterior spinal fusion for correction of the deformity and both were patients that did not have a change in their kyphosis with brace treatment. In both cases the patient and families cited that they were unhappy with the persistent kyphotic deformity. One of these patients also began to develop back pain. The patient who had worsening of the kyphosis from 65 degrees to 73 degrees during brace treatment was offered surgery but elected not to undergo operative treatment.

DISCUSSION

This is the first report in the last 20 years examining the effect of TLSO bracing on Scheuermann's Kyphosis with a minimum of two-year follow-up. Historically, the Milwaukee brace has been recommended to treat Scheuermann's kyphosis as reported by Bradford *et al.* from 1974, which demonstrated its efficacy in treating Scheuermann's kyphosis [4]. A subsequent study comparing the Milwaukee brace to the Boston TLSO-style brace by Gutowski *et al.* in 1988 showed that both braces were effective in treating Scheuermann's Kyphosis [5]. They showed that while the Milwaukee brace had improved correction compared to the Boston brace (27% vs. 35%, respectively), patient compliance was more than twice as high with the TLSO-type Boston brace. From their study, they concluded that the Boston TLSO brace was an acceptable alternative to the Milwaukee brace for kyphosis of less than 70 degrees, but the Milwaukee brace is better suited than the Boston brace for curves greater than 70 degrees [5].

Our finding that 4 skeletally mature subjects with an average kyphotic deformity of 71 degrees improved is in agreement with the findings reported by Bradford *et al.* Although they were using a Milwaukee brace and not a TLSO, they found that "skeletal

maturity does not necessarily contraindicate treatment with the Milwaukee brace [6]."

Limitations of this study include that it is a purely retrospective, non-blinded study and that only 12/126 (9.5%) of the patients treated for Scheuermann's met the inclusion criteria. The majority of these (105/126; 83.3%) were excluded due to lack of follow up. Additionally, the patients in this review predate the use of thermal monitors to objectively measure compliance with brace wear. Nevertheless, this is the first study since the series by Gutowski in 1988 to evaluate the use of a TLSO brace for Scheuermann's Kyphosis which has a minimum of two-year follow up. Further, these results show improvement in kyphotic deformity from Scheuermann's kyphosis in patients that are skeletally mature and with severe kyphosis (greater than 70 degrees) treated with a TLSO. As improvement in kyphosis at skeletal maturity and with severe deformity is possible with TLSO brace treatment, we recommend that a trial of bracing be considered in these cases.

REFERENCES

1. Ali RM, Green DW, Patel TC. Scheuermann's kyphosis. *Curr Opin Pediatr.* 1999; 11: 70-5.
2. Scheuermann H. Kyfosis dorsalis juvenalis. *Zeitschrift fur Orthopadische Chirurgie* 1921; 41.
3. Tsirikos AI, Jain AK. Scheuermann's kyphosis; current controversies. *J Bone Joint Surg Br.* 2011; 93: 857-864.
4. Bradford DS, Moe JH, Montalvo FJ, Winter RB. Scheuermann's kyphosis and roundback deformity. Results of Milwaukee brace treatment. *J Bone Joint Surg Am* 1974;56:740-58.
5. Gutowski WT, Renshaw TS. Orthotic results in adolescent kyphosis. *Spine (Phila Pa 1976)* 1988; 13: 485-9.
6. Sørensen KH. Scheuermann's Juvenile Kyphosis: Clinical Appearances, Radiography, Aetiology, and Prognosis. Copenhagen: Enjar Munksgaard Forlag 1964.

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