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Curve Analysis After Bracing in Scoliosis Patients

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Abstract

Bracing is one of the scoliosis treatment methods recommended for patients with a curve of 25° to 40° still growing child or with curves less than 25°. Bracing aims to prevent the progression of curvature. This study aimed to evaluate the decrease in the Cobb angle after a 3-month bracing in scoliosis patients. We retrospectively reviewed the medical records of 67 scoliosis patients for age, gender, and the Cobb angle before and after wearing a brace for 3 months. The data was analyzed using a paired t-test with a confidence level of 95%. The research results showed that scoliosis is predominant in females (76.12%) and at 10-15 years old (60.78%). The mean pre-brace Cobb angle of 24.94° (±7.24) was reduced significantly ($P < 0.001$) to 16.37° (±7.34). The use of a brace in scoliosis patients, especially teenagers, can correct the curvature of the spine.

Keywords: Scoliosis, Brace, Cobb angle

1. Introduction

Scoliosis is a spinal disorder that causes the spine to curve to the left or right more than 10°.[1] The most common cause of scoliosis cases is idiopathy.[2] Still, some evidence shows that it is multifactorial: genetic factors, abnormal spinal growth and structure, abnormal spinal mechanics, abnormal platelet microstructure, and melatonin secretion related to growth.[3]

Globally, the prevalence of scoliosis is 2-3% and occurs more often in women than men with a female: male ratio of 15:11.[4] Scoliosis is more common in adolescent girls and is usually seen around the age of 10 until bone growth stops at age.[5] In Indonesia, the prevalence of scoliosis is around 0.72–4.3%,[6] and more females suffer from it than males.[6,7]

Most cases of scoliosis will have no other symptoms other than spinal curvature abnormalities.[8] However, back pain sometimes becomes the main complaint.[9] Untreated scoliosis sufferers can aggravate the deformity of the spine, causing back pain, lumbar radiculopathy, cosmetic problems, nerve damage, and even limited movement of the heart and lungs. Untreated patients with curvature greater than 80° may experience severe shortness of breath.[8]

Scoliosis treatment is aimed at slowing or stopping the progression of the scoliosis curve during the growth period. Scoliosis treatment options include bracing, surgery, or non-surgical interventions such as physiotherapy. The choice of treatment depends on the degree of curvature and the potential for further growth of the spinal curve.[8]

The usage of a brace in scoliosis patients is a conservative treatment that aims to support and restore spinal posture. Braces generally must be worn at least 20 hours per day for 2-4 years until bone growth stops. It is indicated for sufferers of idiopathic scoliosis with a curvature angle between 20° and 45° with an immature spine.[10] Patients who do not show worsening of the curvature after

wearing a brace can undergo surgical treatment.[11]

Bracing is an effective treatment to slow or stop the progression of spinal curvature in scoliosis patients who are not yet skeletally mature. Based on a meta-analysis of 20 studies, shows that wearing a brace 23 hours per day is significantly more effective than other non-operative treatments.[12] Correction of spinal curvature can be assessed after 3 months of brace use. This initial curve correction can predict the final results in assessing the effectiveness of wearing a brace.[13] Based on the description above, we are interested in analyzing differences in the degree of scoliosis before and after wearing a brace in scoliosis patients who have worn a brace for 3 months.

2. Method

This research was conducted using a retrospective approach at the Recons Fit Clinic, Palembang, Indonesia. The research data are age, gender, and the Cobb angle before and after wearing a brace for 3 months taken from the medical records of all scoliosis patients during the 2020-2022 period. Patients who wore a brace before and after undergoing scoliosis surgery were excluded from the research subjects. Analysis of differences in Cobb angle before and after wearing a brace was carried out using a paired t-test with a confidence level of 95%.

3. Result

Research data from 67 medical records shows that most scoliosis patients are females (76.12%). Based on the age range, the majority of scoliosis patients are 10-15 years old (60.78%) as shown in Table 1. Before using the brace, the smallest Cobb angle was found in scoliosis patients aged 10-15 years (24.35°(±7.39)) and the largest Cobb angle was found in scoliosis patients aged 21-25 years (28°(±7.94)). There is a significant difference between the Cobb angle before (24.94°(±7.24)) and after wearing the brace (16.37°(±7.34)) for 3 months (P < 0.001) (Table 2).

Table 1. Distribution of scoliosis patients based on age and gender

Age (year)	All (N = 67)	Male (N = 16 (23.88%))	Female (N = 51 (76.12%)
10 - 15 (n(%))	40 (59.70)	9 (56.25)	31 (60.78)
16 – 20 (n(%))	24 (35.82)	5 (31.25)	19 (37.25)
21 – 25 (n(%))	3 (4.48)	2 (12.5)	1 (1.96)

Table 2. Cobb angle analysis before and after wearing a brace in scoliosis patients

Cobb Angle	Age (Years Old) 10-15	16-20	21-25	All	p
Before bracing, (μ(SD))	24.35°(7.39)	25.54°(7.07)	28°(7.94)	24.94°(7.24)	<0.001
After bracing, (μ(SD))	16.23°(7.79)	16.58°(7.06)	16.67°(4.16)	16.37°(7.34)	

4. Discussion

In this study, scoliosis patients were mostly females and teenagers (10-15 years old). The results of this research are in line with previous research in China,[14] in Korea,[15] in Brazil,[16] in Singapore,[17] and in Turkey.[18] Adolescent girls are more likely to suffer from scoliosis because the curvature of the spine progresses in puberty, and females enter physiological puberty early.[14] The higher incidence of scoliosis in females compared to males is believed to be caused by the fact that females tend to grow more than males during adolescence.[19]

Scoliosis will worsen substantially in most cases during pubertal growth spurt. Puberty starts at 11 years of bone age in girls and 13 years of bone age in boys. During the pubertal growth spurt, growth is far more noticeable in the trunk than in the lower limbs, 2/3 of growth is at the level of the trunk and 1/3 at the level of the lower extremity.

Puberty is a turning point in children with scoliosis because the pubertal growth spurt increases the risk of developing the deformity.[20]

The results of this study show that the average Cobb angle before wearing a brace is 24.94° (±7.24). The use of a brace is indicated in scoliosis patients with a spinal curve of 20 to 40°. The use of a brace is not effective in preventing progression in scoliosis patients who have a curve > 40°. The brace is worn at least 20 hours per day for two to four years until bone maturation and the end of bone growth.[12] The previous study showed that bracing is an effective treatment to slow the curve progression in adolescent patients compared with those untreated by this method.[21]

The results of the data analysis showed a significant decrease in the Cobb angle after using the brace for 3 months ($P < 0.001$). As shown in this study, the mean pre-brace Cobb angle of 24.94° (±7.24) was reduced to 16.37° (±7.34) following brace usage for 3 months, a decrease in the Cobb angle of 8.57° (more than 5°). The results of this study are in line with the results of previous research in Italy which found a significant reduction in the Cobb angle from 31.75 (± 8.8) to 17.91 (± 8.62) after 3 months of wearing the brace.[22] Initial curve correction in the first 3 months of brace use can be predictive of the outcome of brace discontinuation. Maximum improvement may occur if the Cobb angle changes > 5°.[13]

Brace treatment effectiveness has been well documented by several studies. Despite the high amount of dedicated research, the role of the biological and mechanical factors is not completely clear. The braces, applying external constraints, modified the mechanical behavior of the scoliotic spine and its natural dynamics. Any corrective effect on biological structures can be stimulated only when vertebral remodeling can be determined by mechanical actions. When the mechanical action is efficient, it promotes vertebral remodeling and the recovery of symmetric vertebral growth. These are fundamental requisites for healthy spinal growth and to obtain an improvement of the curve.[22]

5. Conclusion

In conclusion, the use of a brace in scoliosis patients, especially in adolescent patients with a Cobb angle < 40°, seems to provide improvement in the first 3 months of use. This can be a prediction of maximum improvement in the final results of wearing the brace.

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References

1. Candra, R & Trifani, F. In-Brace Correction (ibc) terhadap tipe dan besaran kurva pada pasien adolescent idiopathic scoliosis (AIS). Quality:Jurnal Kesehatan. 2020;14(1): 46-52.
2. Thompson JY, Williamson EM, Williams MA, Heine PJ, Lamb SE; ACTIvATeS Study Group. Effectiveness of scoliosis-specific exercises for adolescent idiopathic scoliosis compared with other non-surgical interventions: a systematic review and meta-analysis. Physiotherapy. 2019 Jun;105(2):214-234.
3. Dunn J, Henrikson NB, Morrison CC, Blasi PR, Nguyen M, Lin JS. Screening for Adolescent Idiopathic Scoliosis: Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA. 2018 Jan 9;319(2):173-187.
4. Singh H, Shipra, Sharma V, Sharma I, Sharma A, Modeel S, Gupta N, Gupta G, Pandita AK, Butt MF, Sharma R, Pandita S, Singh V, Rai E, Ikegawa S, Sharma S.

The first study of epidemiology of adolescent idiopathic scoliosis shows lower prevalence in females of Jammu and Kashmir, India. Am J Transl Res. 2022 Feb 15;14(2):1100-1106.

5. Zein RH. Pengaruh pemberian terapi latihan metode schroth terhadap scoliosis pada usia 10-12 tahun di sekolah dasar negeri 01 kota jambi. Jurnal akademika Baiturrahim Jambi. 2018;6(2): 88-94.
6. Ramadhani AN, & Romadhoni DL. Prevalensi Adolescent Idiopathic Scoliosis: Literature Review. Care: Jurnal Ilmiah Ilmu Kesehatan. 2022;10(1):101-107.
7. Komang-Agung IS, Dwi-Purnomo SB, Susilowati A. Prevalence Rate of Adolescent Idiopathic Scoliosis: Results of School-based Screening in Surabaya, Indonesia. Malays Orthop J. 2017 Nov;11(3):17-22.
8. Menger RP, Sin AH. Adolescent Idiopathic Scoliosis. In: StatPearls [Internet]. 2024 Jan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK499908/
9. Altaf F, Gibson A, Dannawi Z, Noordeen H. Adolescent idiopathic scoliosis. BMJ. 2013 Apr 30;346:f2508.
10. Kalichman L, Kendelker L, Bezalel T. Bracing and exercise-based treatment for idiopathic scoliosis. J Bodyw Mov Ther. 2016 Jan;20(1):56-64.
11. Ruffilli A, Fiore M, Barile F, Pasini S, Faldini C. Evaluation of night-time bracing efficacy in the treatment of adolescent idiopathic scoliosis: a systematic review. Spine Deform. 2021 May;9(3):671-678.
12. Kaelin AJ. Adolescent idiopathic scoliosis: indications for bracing and conservative treatments. Ann Transl Med. 2020 Jan;8(2):28.
13. Xu L, Qin X, Qiu Y, Zhu Z. Initial Correction Rate Can be Predictive of the Outcome of Brace Treatment in Patients With Adolescent Idiopathic Scoliosis. Clin Spine Surg. 2017 May;30(4):E475-E479.
14. Cai, Z., Wu, R., Zheng, S. *et al.* Morphology and epidemiological study of idiopathic scoliosis among primary school students in Chaozhou, China. *Environ Health Prev Med*. 2021;**26**:71.
15. Suh SW, Modi HN, Yang JH, Hong JY. Idiopathic scoliosis in Korean schoolchildren: a prospective screening study of over 1 million children. *Eur Spine J*. 2011;20(7):1087-1094.
16. Nery LS, Halpern R, Nery PC, Nehme KP, Stein AT. Prevalence of scoliosis among school students in a town in southern Brazil. *Sao Paulo Med J*. 2010;128(2):69-73.
17. Wong HK, Hui JH, Rajan U, Chia HP. Idiopathic scoliosis in Singapore schoolchildren: a prevalence study 15 years into the screening program. *Spine (Phila Pa 1976)*. 2005;30(10):1188-1196.
18. Cilli K, Tezeren G, Taş T, Bulut O, Oztürk H, Oztemur Z, Unsaldi T. School screening for scoliosis in Sivas, Turkey. *Acta Orthop Traumatol Turc*. 2009;43(5):426-430.
19. Wei-Jun W, Xu S, Zhi-Wei W, Xu-Sheng Q, Zhen L, Yong Q. Abnormal anthropometric measurements and growth pattern in male adolescent idiopathic scoliosis. Eur Spine J. 2012;21(1):77–83.
20. Dimeglio A, dan Canavese F. The immature spine: growth and idiopathic scoliosis. Annals of Translational Medicine. 2020;8(2):34315.
21. Asher MA, Burton DC. Adolescent idiopathic scoliosis: natural history and

long-term treatment effects. Scoliosis. 2006;1:2.

22. Aulisa AG, Galli M, Giordano M, Falciglia F, Careri S, Toniolo RM. Initial In-Brace Correction: Can the Evaluation of Cobb Angle Be the Only Parameter Predictive of the Outcome of Brace Treatment in Patients with Adolescent Idiopathic Scoliosis? Children (Basel). 2022 Mar 2;9(3):338.