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Review Article

The Influential Factors in Determining the Efficiency of Bracing in Controlling Scoliotic Curves: A Narrative Review of Literature

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Abstract

Background: Various treatment approaches can be used for individuals with scoliosis deformity, with bracing playing a significant role. The aim of this review was to assess the effectiveness of bracing in controlling scoliotic curves based on studies published between 2018 and 2025.
Methods: A search was conducted in databases such as PubMed, Google Scholar, ISI Web of Knowledge, and Scopus using keywords like brace, orthosis, and scoliosis between 2018 and 2025. Papers were selected based on the research question of interest (effectiveness of bracing in preventing scoliotic curve progression).
Results: This narrative review highlighted the importance of certain parameters in predicting the outcomes of brace treatment. Factors such as Risser sign, initial Cobb angle, in-brace correction (IBC), curve type, vertebral rotation, brace wearing time, type of brace, and poor compliance all influence the effectiveness of bracing treatment.
Conclusion: It appears that the outcomes of bracing treatment in individuals with scoliosis can be predicted based on certain parameters. The findings of this review assist clinicians in determining the effectiveness of bracing in individuals with scoliosis.

Keywords: Braces; Scoliosis; Spine; Treatment Outcome

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Background

Scoliosis is a three-dimensional deformity of the spine. It is characterized based on the patient's age at the onset of the disease, severity, etiology, and type of the curves (1-3). Based on the etiology of the deformity, it is subdivided into idiopathic (unknown cause) and non-idiopathic. Depending on the age of the subjects, idiopathic scoliosis is further classified as infantile scoliosis (0-3 years), juvenile scoliosis (4-10), adolescent (11-18), and adult scoliosis (age > 18 years) (4-6). Adolescent idiopathic scoliosis (AIS) is one of the most common types of scoliosis.

Depending on the severity of the curve and the age of the subjects, various treatment approaches can be used for subjects with scoliosis including surgery and conservative treatment (7, 8). For most of the subjects with a curve less than 40 degrees, conservative treatment is the first choice of treatment option (8, 9). The use of bracing is one of the most common types of conservative treatment used for subjects with scoliosis.

Various types of bracing have been used for subjects with scoliosis. The Milwaukee brace, Boston brace, Rosenberger brace, Miami brace, Providence brace, Cheneau brace, derotational brace, and asymmetric rigid torsion (ART) Lyon brace are some of the most commonly-used braces (7, 10-12). The efficiency of the aforementioned braces may differ from each other, depending on the design of the braces. Moreover, some of the braces should be used full time while others are recommended to be used only during the night. The structure of the braces also differs from each other (7). In fact, the available braces can be divided into soft and rigid braces. The rigid braces can also be divided into low-profile and high-profile braces (9).

The main questions posed here are: which of the aforementioned braces are more effective in controlling the progression of scoliotic curves, and which parameters influence the efficiency of braces in controlling scoliotic curves progression. Up to 2018, various research studies showed that the effectiveness of bracing depended on the severity of the scoliotic curve, the location of the curves, the duration of brace use, and the type of brace (7). It appears that Boston brace is more effective than the Milwaukee brace in controlling scoliotic curve progression (10). Additionally, the effectiveness of soft braces seems to be less than that of rigid braces (13). It is recommended that braces should be worn at least 23 hours per day, but compliance with the wearing brace is a factor. Furthermore, braces can impact the quality of life (QOL) of individuals with scoliosis. Since 2018, many studies have been conducted on effectiveness of bracing for scoliotic curve. Therefore, the aim of this narrative review is to assess the effectiveness of bracing for scoliotic curves and to identify the parameters that influence the effectiveness of bracing based on the evidence published from 2018 to 2025.

Methods

A search was conducted in several databases including Google Scholar, ISI Web of Knowledge, PubMed, and Scopus using keywords such as scoliosis and bracing, and 'scoliosis and orthosis'. The search covered the period between 2018 and 2025. Papers were selected based on the research questions of interests, especially focusing on the effects of bracing on scoliotic curves and the factors influencing the efficiency of bracing.

It is important to note that the selection of papers was

based on the publication period, which was between 2018 and 2025.

Results

Several studies have been published on the efficiency of bracing, factors influencing the success rate of bracing, effects of bracing on pulmonary function, and brace wearing time. Studies have evaluated the compliance with bracing and the parameters that influence the level of compliance. The main risk factors mentioned for the progression of a scoliosis curve include: Risser sign, curve magnitude, initial Cobb angle, low value of in-brace correction (IBC), age of the subjects, type of curve, vertebral rotation, and physiological characteristics of the subjects. Other parameters such as poor compliance, time spent wearing the brace, and type of the brace also influence the output of treatment.

Discussion

One of the commonly-used treatment approaches for subjects with scoliosis is the use of braces. Various types of braces are available for individuals with scoliosis. The aim of this study was to determine the effectiveness of braces and factors influencing the outcomes of treatment based on studies published between 2018 and 2025.

Some factors have been identified as risk factors that can be used to predict the outcomes of treatment with braces. One such factor is the Risser sign. Patients with a curve above 40 and a Risser sign of 0 have the highest risk (14). There appears to be a risk of 70-100 percent for curves above 40 with brace treatment (15).

Poor compliance is another factor that influences the outcomes of treatment with braces. Effective brace treatment requires a high level of compliance, defined as wearing the brace for 10-12 hours per day (16). According to a study by Rahimi et al., compliance is dependent on appropriate intervention and the mental and physical condition of patients (17). The amount of time spent wearing the brace also depends on the appearance and design of the brace, the age of the individual, and their psychological characteristics (17).

The type of brace is another parameter that influences the level of compliance. Factors such as structure, color, style, rigidity, and body coverage can affect a patient's interest in wearing the brace, ultimately impacting compliance (17). While rigid braces may be more efficient in controlling curve progression, they come with drawbacks such as high temperature, pressure on bony areas, difficulty in putting on and taking off, limited clothing options, and restricted movement (18). It is undeniable that bracing has an impact on the QOL of individuals with scoliosis. Self-image, mental health, and vitality are three important factors that influence QOL, and any new braces should be designed with these parameters in mind (19).

Initial Cobb Angle: It has been noted that an initial Cobb angle of > 30 to 40 is a risk factor. However, it is important to emphasize that the progression of the scoliotic curve beyond 30 also depends on the age and Risser grade of the individual. Subjects with an initial Risser grade of 0 and an initial correction rate (ICR) of <10% are at a higher risk of bracing failure (15).

Low Value of IBC: This parameter is crucial in predicting the effectiveness of bracing. IBC is defined as the percentage of Cobb angle reduction in the brace based on X-ray results. Studies have shown that a minimum of 25% IBC is necessary for successful treatment of double curves (20). It has been suggested that bracing should not be recommended for IBC values less than 20% (21). Additionally, research has found that IBC over 40% significantly impacts treatment outcomes (22). Therefore, an IBC between 20% and 40% is associated with positive treatment outcomes when using bracing.

Curve Type: It seems that main thoracic and double curves are more prone to progression due to reduced flexibility of the thoracic spine and less potential for correction. Emans et al. showed that major curves with apical levels below T8 and above T12 demonstrated better control (23). Therefore, it may be concluded that thoracic curves have a higher probability of progression than other curve types. A curve in the thoracic area may be a risk factor (14).

Vertebral Rotation: Vertebral rotation especially in the thoracic area is considered a risk factor for curve progression (14). Pelvic rotation was also mentioned as a risk factor for prediction of curve progression; however, there is not enough evidence to support it (24). Gum et al. reported that pelvic rotation occurred mostly toward the convexity of the thoracic curve, which mostly happens as a compensatory mechanism (25).

Brace Wearing Time: Brace wearing time is also mentioned as a risk factor for failure of bracing treatment. Based on available literature, a brace should be worn for at least 14 hours per day. In the research done by Konieczny et al., three groups of brace wearing time, 12 hours, 12-16 hours, and > 16 hours per day, were evaluated (26). The results of their study showed that there was no statistical difference in the progression of AIS between 12-16 and more than 16 hours. They concluded that patients could attend school without a brace (26).

Type of Brace: One of the important questions regarding the outcome of treatment with bracing is the effects of brace design on scoliotic curve correction. Based on the results of various studies, the type of brace may influence the amount of correction of the scoliotic curve. It should be emphasized that the type of brace influences the compliance (17). Some parameters such as the structure of the brace, color, style, rigidity, and body coverage influence compliance. There was also a study on the comparison between night- and day-time bracing. The interesting point was that there seems to be no statistical difference in primary and secondary outcomes between night-time and day-time bracing (16).

Body Mass Index (BMI): BMI also influences the outcomes of treatment with bracing. According to a study by Karavidas, both low and high BMI are associated with a greater risk of brace failure (27). Patients with high BMI failed because they had significantly lower IBC and less compliance. However, long-term tracking of BMI in patients with AIS showed that initially underweight patients with AIS were more likely to remain underweight after skeletal maturity. Low BMI could be a predictive factor for brace failure (27).

Among all the parameters mentioned above, the degree of curvature and the growth of the subjects appear to be more important in predicting the outcomes of treatment with bracing. There is evidence that the correction of scoliosis with braces also depends on factors such as pelvic rotation, pelvic alignment, lordosis, and kyphosis of the vertebral column (24). A larger pre-brace lordosis with smaller in-brace kyphosis and less pre-brace thoracic rotation were associated with progression of less

than 5 degrees (28). A larger out-of-brace lordosis was a predictor of stability while bracing. Therefore, a brace design that modifies the sagittal profile curve can have a significant impact on the outcomes of bracing.

Conclusion

Based on the results of studies published between 2018 and 2025 on scoliotic treatment with braces, it appears that several parameters can be used to predict the outcomes of brace treatment. These parameters include the severity of the curve, type of brace, duration of brace use, magnitude of IBC, vertebral rotation, brace wearing time, and compliance.

Conflict of Interest

The authors declare no conflict of interest in this study.

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