

Bracing adolescent idiopathic scoliosis today

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Abstract

Purpose. The purpose of this report is to give an overview of the existing literature on bracing for scoliosis, and to introduce a special issue of the journal on this topic. We look critically at this treatment, considering not only the possible efficacy but also other key points such as compliance, acceptability and the patient's quality of life, as well as the variability of existing braces.

Method. Review of the literature.

Results. Bracing is questioned in terms of efficacy, but in most cases no alternative exists other than to wait for eventual surgery, or perhaps to do nothing and facing the likelihood of problems with increasing age. Compliance is a critical point, but it isn't a reason to quit. On the contrary, it should be a stimulus for professionals to find the better ways to help their patients in this respect. When faced with the possible alternatives, patients do prefer bracing to the so-called 'wait and see' strategy, but we must continue to work to reduce the impairment to quality of life due to the orthosis. The actual variability of braces should be faced, and the BRACE MAP classification is proposed as a unifying tool for the future.

Conclusions. Bracing is not the best possible treatment, but in the case of scoliosis the alternatives are even more challenging. Thanks to the International Society on Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT) serious research is ongoing, and in the next few years we will have more data, not only on efficacy but also on compliance, acceptability and quality of life, biomechanics, evaluation tools, informatics in bracing, etc. Hopefully this will lead to better results and choices for our patients.

Keywords: *Adolescent idiopathic scoliosis, bracing, rehabilitation*

Introduction

This issue of *Disability and Rehabilitation: Assistive Technology* is dedicated to bracing for scoliosis, mainly the adolescent idiopathic (AIS) type, but it also includes a paper related to neurological ones. In this short introduction we seek to look critically at this treatment for AIS, considering not only the possible efficacy but also other key points such as compliance, acceptability and quality of life, as well as the variability of existing braces.

Scientific evidence today (i.e., efficacy and compliance)

The possibility of obtaining results with bracing depends on a continuous balance between the efficacy of the instrument and the possibility of

obtaining good compliance. Consequently, the principles of good bracing must look at both issues (Table I) [1].

Efficacy

Bracing has been questioned by many [2,3], but it remains the most important conservative treatment for scoliosis [4,5]. The only alternative is the 'wait and see' approach, which means doing nothing but wait for an eventual fusion of the spine. The recently published metanalysis with negative results of bracing for scoliosis [3] reports only on papers published in English, while it excludes any kind of adjuvant therapy, such as exercises. In this respect the papers published in the international literature on bracing plus exercises [6–10] have much better results, with a surgical rate of less than 10% versus

Table I. Principles of correction through braces must look at efficacy but also compliance that can be reached through acceptability of the instrument used [1].

Efficacy principles	Acceptability principles
The active brace principle*	Perfect body design and minimal visibility
Mechanical efficacy	Maximal freedom in the ADL (Activities of Daily Life)
Versatility and adaptability	Assumption of responsibility
Teamwork	Cognitive-behavioural approach
Compliance	

*This principle imply requiring the patient to move as much as possible (specific exercises, sport and ADL) to increase mechanical pushes of the brace and compliance, and to allow better neuromotorial reorganization [1].

the 22–23% reported by Dolan [3]. Therefore, it is possible that a full conservative approach, including not only bracing but also exercises, could be much more efficacious than simple bracing. This is already the standard for professionals engaged in the new International Society on Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT – www.sosort.org) [11–15], but it is not the case in the surgical community. On the other hand, what do we know about surgery and its efficacy? No controlled studies exist [16,17], and the long-term results are not really as good as should be expected for such an invasive technique [18,19]. In this situation it is not completely clear why bracing should be abandoned, as proposed by some authors [20,21], in favor of... what... fusion, or perhaps nothing?

Another key point of the efficacy issue concerns the kind of bracing that is used. In other words, is there currently any standard to be considered? Approaches to bracing, as evidenced by this issue of *Disability and Rehabilitation: Assistive Technology*, are numerous and diverse. Moreover, individual physicians apply the same braces in different ways, with a significant personalization of treatment, that certainly justify part of the variability of results [12]. Over the long course toward the achievement of at least some standardization, which started in SOSORT, we must now consider that even the way bracing is applied (not simply the means used) has scant consideration in the literature: No papers exist on the topic (SOSORT is preparing the next consensus on this), nor do the papers published on results of bracing consider such an important issue. It is not difficult for anyone to understand that results will be very different from a physician who prescribes a brace believing that in this way he/she can obtain a result (and so taking care of all particulars, starting from the orthotist involved to the conception, application and verification of the orthosis, and the physiotherapist involved in exercises and counselling) to another physician who

prescribes the same brace without any care, thinking that if he fails he can in any case operate. Nevertheless, the last is today really the standard instead of an exception [22].

Compliance

Obviously, no treatment can work if it is not used by the patient. Compliance is a key issue in bracing [23–27], but today it seems to be considered as a reason not to apply braces (because patients have no compliance) instead of something that must be obtained through a careful approach to the patient and family. Compliance should be regarded as a failure of the treating physician and team, not as a failure of treatment. There are certainly therapies in medicine that cost (not economically but personally) much more than braces. These are applied whenever necessary, and the aim of a good physician in such cases is to obtain compliance instead of avoiding treatment if compliance is difficult to achieve. This is not the only point to consider in choosing a treatment, because there are personal, medical, individual and social values that are far more important in these choices, but compliance can't be regarded as an excuse to avoid bracing.

What patients want – acceptability and quality of life

The professional side of bracing must be accompanied by the patient side, beyond the medical problem of compliance already mentioned. The issues of acceptability and quality of life must be raised and considered.

Acceptability

A study [28] we previously conducted was used to explore the issue of acceptability of treatments for scoliosis, meaning what patients think when they look at the possible treatment alternatives. We used a questionnaire to elicit evidence-based opinions in a sample of 3262 Italian families with children not affected by AIS. Patients clearly support the use of screening (94.8%) at school, immediate bracing (76.4%) for scoliosis with a 60% risk of progression, but also therapeutic exercises (86.9%) instead of observation in cases with a 25% risk of progression. The first choice for a 'wait and see' strategy, and eventual fusion in this sample was considered by 2.59% (95%; confidence interval 1.37–3.82) [22]. According to these results, bracing is an acceptable treatment when things are carefully explained. In the past this point was based only on our everyday experience, but now there is also some evidence to support it.

Quality of life and disability

Bracing impairs quality of life [14,29,30] and causes a transient disability [31–33]. Still, the question is whether that is justified [34]. We have to work to minimize the impact of braces through technical aids [35], through materials [36,37], through design [38,39], or through any means available. In the meantime we need to understand the maximum of hours of brace wearing will be required [40–42] for each type of curve, so as to possibly reduce the impact on our patients. We have to overcome the concept of our own brace and arrive at the idea of the correct brace for the correct patient, according to a modern view of what evidence-based medicine really is: ‘Integration of the best research evidence with clinical expertise and patient values’ [43]. In all this we have to maintain that for most patients the only alternative to bracing is to have a curve that will cause problems in adulthood [14,44], or to be operated upon (fused), which is to lose the function of spinal mobility in favour of stability. In summary, it is the question of a transient disability today (through bracing) in order to avoid a permanent disability (through fusion), or to prevent possible impairments and disability in the future (doing nothing): The medical balance is there, and choices must be made on an individual basis.

The technical factor – types of braces and a possible classification

Today we are in the situation that braces are called by names usually derived from towns or the people that have developed the orthosis, but such names are totally distinct from their functions and/or mechanisms of action. The only existing classification is an anatomical one, which considers the part of the trunk involved in the brace (C: cervical; T: thoracic; L: lumbar; S: sacral; orthosis). This obviously does not allow us to understand the correlation of such a name, nor to confront the different tools in any way.

A survey of the existing braces presented in this issue of Disability and Rehabilitation: Assistive Technology seems to show these different categories:

- Milwaukee brace [45], whose mechanism of action is mainly in auto-elongation: Past results have been quite good on scoliosis, but the patient pays a three-dimensional (sagittal worsening), and psychological price;
- Overnight braces [42], whose aim is to reduce the psychological impact: However, the limitation exists unavoidably reduced time of wearing;
- ‘Postural’ braces, which aim to reverse the posture with respect to the one imposed by the

deformity, in order to achieve the maximum possible correction: These include a rigid one such as the Cheneau-2000 [46], and a flexible one such as the SpineCor [37]. From another perspective they are based on completely different principles, because one maintains correction while the other proposes correction but allows full movement. The first one has a price in terms of wearability, while the second one could have its limitation in the forces applied;

- Pushing braces, like the Lyon [47], Sforzesco [38], Boston and TriaC braces [36].

We recently initiated an effort to propose and verify, within SOSORT, a new classification of braces called BRACE MAP, which is an acronym for the items considered for classification. The actual evolution of this tool includes the following items (Table II): Building, Rigidity, Anatomical classification, Construction of the Envelope, Mechanism of Action and Plane of action. Each item is composed of 2–7 classificatory elements, defined using one or two letters, so that from the classification it is possible to derive the characteristics of the brace. To give an example, the SpineCor is classified as CpETAM3, which means Custom positioning, Elastic, TLSO, Asymmetric, Movement principle, 3-D correction. In a preliminary study we applied the BRACE MAP to 13 braces, which were all correctly differentiated, with the exception of only two. This classification is now under discussion in SOSORT

Table II. Items constituting the classification BRACE MAP.

Acronym	Item	Possible choices
B	Building	C – Custom Cp – Custom positioning P – Prefabricated envelope
R	Rigidity	S – Soft, not elastic E – Elastic R – Rigid V – Very rigid
A	Anatomical	C – CTLSO T – TLSO L – LSO
CE	Construction of the envelope	S – Symmetric A – Asymmetric
MA	Mechanism of action	T – Three-point E – Elongation P – Push M – Movement
P	Plane of action	3 – 3-D F – 2-D frontal H – 2-D horizontal S – 2-D sagittal Fh – Combined frontal/horizontal Fs – Combined frontal/sagittal Hs – Combined horizontal/sagittal

for future application, and we hope that through this tool, which is presented here for the first time, it will be possible in the near future to move forward with better knowledge and classification of braces.

A look at the future (with hope)

A new era is now in sight, because the different theories behind the main existing braces are now confronted in the newborn SOSORT through its annual Meetings and its Journal "Scoliosis" (www.scoliosisjournal.com), and serious research is going on as part of an international effort to increase the pool of knowledge in this field. Hopefully in the next few years we will have more data and more research, not only on efficacy but also in most of the points raised in this editorial and others such as biomechanics of bracing, evaluation tools, informatics in bracing, and so on. As a clinician I am ready to change my treatments as soon as others will show better efficacy and/or reduced burden on patients. To put it simply, surgery is not an alternative to bracing, nor is doing nothing, which is politely called 'observation' ('wait and see'). Perhaps in the distant future genetics will provide an answer, but until that happens braces are still the best solution for many patients.

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