



(RESEARCH ARTICLE)



Management of spinal deviations in physical medicine and functional rehabilitation

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Abstract

Objectives: To analyze cases of spinal deviations in the Physical Medicine and Rehabilitation (PMR) department at Mohammed VI University Hospital Center in Marrakech, with a focus on the role of rehabilitation in their management.

Methods and Patients: We conducted a cross-sectional, observational descriptive study over a six-month period involving 52 patients with spinal deviations, treated in the PMR department. Data were meticulously collected using a questionnaire completed during consultations with patients selected according to specific criteria.

Results: The study revealed that the average age of the patients was 21.25 years, with a predominance of females (68%). Among the spinal deviations, scoliosis was the most common (68%), followed by scoliotic posture (18%), hyperkyphosis (11%), and compensatory lumbar hyperlordosis (3%). The primary reason for consultation was aesthetic concern (56%), with the most frequent symptoms being gibbus deformity (54%) and shoulder asymmetry (35%). Rehabilitation was prescribed for all patients, sometimes as the sole treatment or in combination with bracing. Orthoses were used to correct foot deformities and leg length discrepancies. Only one patient underwent surgical intervention. The outcome was positive for 63% of patients, with improvement in the Cobb angle and pain reduction. However, a 5° worsening was observed in one patient (2% of the sample), while the others remained stable.

Conclusion: In conclusion, the therapeutic approaches employed in our sample demonstrated their effectiveness in managing spinal deviations. Rehabilitation proved to be particularly essential as an adjunct treatment, enhancing the outcomes of other therapies and contributing to the relief of back pain, which had a positive impact on patients' quality of life.

Keywords: Spine; Scoliosis; Kyphosis; Bracing; Rehabilitation

1. Introduction

The spine, or vertebral column, is a critical osteoarticular structure in humans. It provides a robust framework that maintains posture, supports the body's weight, and protects the spinal cord. At the same time, it must possess sufficient flexibility to enable trunk and head movements [1].

This essential function of the spine is maintained through a specific anatomical arrangement, consisting of a series of vertebrae stabilized by ligaments and a well-developed muscular system. However, pathological alterations in this vertebral alignment can arise from congenital, neuromuscular, degenerative, or idiopathic factors, leading to spinal deviations or deformities.

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Such deformities represent a prevalent pathological condition both locally and worldwide. Their progression is frequently marked by an asymptomatic onset, which can sometimes go unnoticed. Nonetheless, deterioration can occur at any growth stage, particularly during puberty [2], potentially compromising the patient's functional prognosis with respect to respiratory, neurological, and cardiac health, as well as having a significant psychosocial impact.

Early detection and regular follow-up are crucial to prevent complications and ensure satisfactory outcomes, both aesthetically and functionally [2]. This necessitates a multidisciplinary approach involving various medical specialties, including physical medicine and functional rehabilitation. In this context, we have undertaken this study to report on the experience of our department in managing spinal deviations at the Mohammed VI University Hospital (UHC) in Marrakech.

Our objectives are to:

- Analyze cases of spinal deviations within the physical medicine and functional rehabilitation department.
- Highlight the role of rehabilitation in the management of these deviations

2. Material and methods

This is a cross-sectional, descriptive, and observational study conducted on patients with spinal deviations followed at the Physical Medicine and Functional Rehabilitation (PMR) Department of Mohammed VI University Hospital (UHC) in Marrakech from January 2023 to July 2023. The sample was constituted by selecting patients based on specific inclusion and exclusion criteria.

Exclusion criteria included patients with incomplete or unusable records, as well as those who were lost to follow-up.

Data collection was rigorously conducted using a specifically designed questionnaire. This questionnaire was filled out by the investigator during consultations with patients presenting with spinal deviations, ensuring the reliability and accuracy of the collected information.

The questionnaire was structured into six distinct sections. The first section was dedicated to describing patient profiles, including information such as age, gender, weight, occupation, etc. The second section covered symptoms, clinical signs, and any relevant information from the clinical examination. The third section aimed to classify the spinal deviation according to its origin, whether idiopathic, congenital, neurological, postural, or other. The fourth section dealt with the results of radiological examinations, such as standard X-rays, magnetic resonance imaging (MRI), or CT scans, allowing for characterization and quantification of the deviation. The fifth section recorded the various treatment modalities used, such as rehabilitation, brace wear, surgery, etc. The sixth section aimed to track the progression of the deviation over time, including progression, stability, or improvement under treatment. This data collection method allowed for the acquisition of comprehensive and detailed information on each patient, which was essential for analyzing and understanding different aspects of spinal deviations.

The collected data were processed and analyzed using Microsoft Excel 2016 software, enabling efficient manipulation of raw data and the creation of various visualizations to facilitate result interpretation.

Additionally, to ensure scientific rigor, bibliographic references were inserted and organized using Zotero software.

The questionnaire adhered to the ethical principles of the Helsinki Declaration established by the World Medical Association. Patients were fully informed about the study's objectives and how their data would be used. We ensured strict patient anonymity, and all collected information was handled confidentially

3. Results

We examined a sample of 52 patients with various spinal deformities, all followed and managed within the Physical Medicine and Functional Rehabilitation Department at Mohammed VI University Hospital (UHC).

The average age of our patients was 21.25 years, with a male-to-female ratio of 0.47 and a female predominance of 68%. In our study, scoliosis emerged as the predominant deformity, representing 68% of all deviations observed in the sample.

Conversely, lumbar hyperlordosis was less common, affecting only 3% of cases. It is noteworthy that these cases of lumbar hyperlordosis were secondary to the presence of scoliosis.

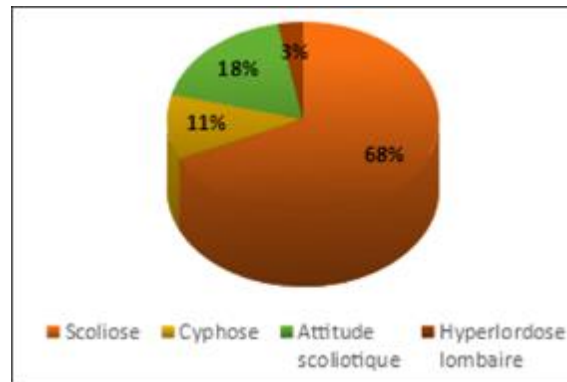


Figure 1 Distribution by Type of Spinal Deviation

We observed an association between kyphosis and scoliosis, commonly referred to as kyphoscoliosis, in two patients, representing 5% of the total number of scoliosis and kyphosis cases in our sample. The most frequent reason for consultation was aesthetic discomfort, reported by 56% of the patients. During the clinical examination of the spine, a gibbus was detected in 48% of the sample, which corresponds to 25 patients, followed by shoulder asymmetry, which was noted in 35% of the individuals. Spinal stiffness was observed in 19% of the patients, while 81% had a flexible spine.

Regarding the radiological assessment, a full-spine X-ray was performed for all patients. The results showed an average Cobb angle of 30.2° in patients with scoliosis, 61° in those with hyperkyphosis, and 4.6° in those with scoliotic posture. The thoracolumbar region was the most frequent location for scoliosis, while the dorsal region predominated in cases of hyperkyphosis and scoliotic posture. No specific abnormalities were revealed by the TDM and MRI scans performed in our sample.

The etiological classification revealed a predominance of idiopathic origin for scoliosis, accounting for 45%, while neuromuscular origin was predominant for hyperkyphosis and scoliotic posture, representing 50% and 60%, respectively.

Rehabilitation sessions were recommended for all patients. In 21 cases, rehabilitation was prescribed as the sole treatment, while in 30 other patients, it was used in conjunction with orthopedic treatment via bracing. Orthotic insoles were also prescribed to treat flat feet in 2 patients, high-arched feet in 2 others, and to compensate for leg length discrepancy in 5 patients. Regarding surgical treatment, only one patient with scoliosis underwent spinal arthrodesis via a posterior approach.



Figure 2 Anterior and posterior view of a CTM brace worn by a patient with idiopathic scoliosis



Figure 3 Anterior and posterior view of a CTM brace worn by a patient with idiopathic scoliosis

The outcome for 63% of the patients was positive, characterized by an average reduction of 8.5° in the Cobb angle and a decrease in pain by an average of 3.3 points on the VAS scale. Conversely, a worsening of 5° was observed in one patient (representing 2% of the sample), while the others showed stable progression.

4. Discussion

4.1. Distribution of Spinal Deviations in Our Sample

The analysis of our results highlighted a significant percentage of scoliosis, representing 68% of all identified deviations. These findings are consistent with those of the series by BOUZID [3], where scoliosis accounted for 73% of cases, further supporting the validity of our observations.

Globally, similar results were observed in the sample by BUENO et al. [4], where scoliosis predominated, representing 33.2% of the screened patients. However, in a study conducted by JASNA et al. [5], 23.1% of the included patients presented with spinal deformities, among which hyperkyphosis were the most common, representing 10.5%, while scoliosis affected 5.2% of the patients.

Table 1 Frequency of Each Deviation According to Different Series

| Studies | Sample size | Scoliosis | Hyperkyphosis | Scoliotic posture | Lumbar hyperlordosis |
|------------------|-------------|-----------|---------------|-------------------|----------------------|
| BOUZID [3] | 11 cases | 73% | 18% | - | 0% |
| BUENO et al.[4] | 864 cases | 33,2% | 16,6% | - | 27,9 % |
| JASNA et al. [5] | 229 cases | 5,2% | 10,5% | - | 9,2% |
| Our study | 52 cases | 68% | 11% | 18% | 3% |

4.2. Therapeutic Management

4.2.1. Therapeutic Management of Scoliosis

In our sample of scoliotic patients, the majority received conservative treatment, combining rehabilitation and bracing in 74% of cases, while only one patient, representing 2%, required surgery. This approach is similar to studies conducted in Côte d'Ivoire by TIAHO et al. [6] and by Smith et al. [7], but differs from those of AIT CHEIHBI [8] and SALHI [9], where conservative treatments were less common, and surgical interventions were more frequent.

In our study, the variety of orthopedic treatments was notable, with 42% of patients fitted with a CTM brace, 21% with a support brace, and 10% with a seating brace. This diversity may be explained by the variability in underlying etiologies and the age groups of the patients included in our sample. In contrast, in AIT CHEIHBI's study [8], treatment involved the repeated use of EDF plaster and a CTM-type corrective brace. Similarly, in SALHI's study [9], the brace used was a Cheneau-type monocoque brace. Finally, the surgical treatment in our study consisted of posterior arthrodesis, similar to that in SALHI [9] and AIT CHEIHBI [8], although these latter studies sometimes combined posterior and anterior approaches.

4.2.2. Therapeutic Management of Hyperkyphosis

Our results demonstrate that rehabilitation was the preferred treatment for hyperkyphosis, benefiting 83% of the patients. This approach aligns with other research, such as the studies conducted by SEIDI et al. [10] and KAMALI et al. [11], which also utilized rehabilitation, particularly corrective exercises and manual therapy, to treat postural hyperkyphosis. In contrast, only 17% of the patients required orthopedic treatment, such as an anti-kyphosis brace, a notable difference compared to the study by MEHDIKHANI et al. [12], which favored the Milwaukee brace. No surgical intervention was required in our sample, unlike the study by CHO et al. [13], where all patients underwent posterior instrumentation and spinal fusion, with concomitant anterior release in 94% of them.

4.2.3. Therapeutic Management of Scoliotic Posture

In our sample, the management of scoliotic posture primarily involved motor rehabilitation sessions to correct muscular and postural imbalances. One patient required a seating brace due to their neuromuscular condition, while two others received orthopedic insoles to correct leg length discrepancy. These methods are consistent with the studies by ALVES DE ARAUJO et al. [14] and PARK, which also employed therapeutic exercises. Additionally, the two patients in our study with leg length discrepancy were provided with orthopedic insoles to compensate for this inequality. Similarly, in the study by RACZKOWSKI et al. [15], the treatment of this condition also involved the use of orthopedic insoles in all patients in their sample (369 patients), except for four who were fitted with external heel lifts. The results indicate that a personalized approach is essential for managing scoliotic posture, taking into account individual causes and needs.

4.3. Evolution under Treatment

4.3.1. Evolution of Patients Who Received Rehabilitation Alone

Scoliosis

In the study, 67% of scoliotic patients showed improvement, primarily in terms of pain reduction, but only two patients demonstrated a decrease in the Cobb angle, while 33% exhibited a stable condition. The study by NEGRINI et al. [16] evaluated the effectiveness of rehabilitation in reducing the need for other treatments. This comparison showed that specific exercises reduced the need for orthopedic treatments in 54% of cases, compared to 48% for conventional physiotherapy.

Hyperkyphosis

For patients with hyperkyphosis, rehabilitation led to improvement in half of them, with an average pain reduction of 2 points on the VAS scale and a decrease in the Cobb angle by 9 degrees. Compared to other studies, these results are relatively promising. For example, the study by KATZMAN et al. [17] showed a reduction of 3.3° in the Cobb angle through specific exercises, while manual therapy and strengthening exercises led to a reduction of 2.51° and 3.17°, respectively, according to the study by KAMALI et al. [11].

Scoliotic Posture

The results of rehabilitation for patients with scoliotic posture indicate that 56% of patients showed improvement, with a reduction in pain of 2.7 points on the VAS scale, while the Cobb angle remained stable. The study by ALVES DE ARAUJO et al. [14] also evaluated the effectiveness of the Pilates method, showing a reduction in pain by 3.5 points, a decrease of 2.8 degrees in the Cobb angle, and an improvement in flexibility among patients.

4.3.2. Evolution Under Orthopedic Treatment Combined with Rehabilitation

Scoliosis

In our sample, patients who underwent a combined treatment of daily orthopedic bracing and rehabilitation sessions showed a significant improvement of 54%, with an average decrease of 6 degrees in the Cobb angle and a reduction of

4 points in pain on the VAS scale. These results are slightly lower than those reported in a study by WEINSTEIN et al. [18], where the success rate was 72%, defined by maintaining the Cobb angle at less than 50 degrees. Other studies conducted by ABDELFETTAH et al. [19], FANG et al. [20], and KWAN et al. [21] also examined the effectiveness of combining brace wear with specific exercises, showing significant improvements compared to bracing alone. However, one patient in our sample experienced worsening of their curvature, likely due to the severity of their neuromuscular scoliosis and poor adherence to brace wear. Nonetheless, our rate of deterioration appears slightly lower than the 5% observed in the similar study by ZHANG et al. [22], and significantly lower than the 21% and 25% rates reported in the studies by KWAN et al. [21] and WEINSTEIN et al. [18], respectively.

Hyperkyphosis

Orthopedic treatment for hyperkyphosis was infrequent in our patient group, limited to a single patient with Scheuermann's hyperkyphosis. The progression of this patient under an anti-kyphosis brace remained stable. However, other studies have reported more positive results. For instance, the study by ETEMADIFAR et al. [23] showed significant improvement in 97.5% of patients treated with a Milwaukee brace, with an average reduction of 24.93° in the Cobb angle. Another study by MOUKOKO et al. [24] evaluated the effectiveness of a plaster cast followed by an anti-kyphosis or Milwaukee brace, demonstrating an average reduction of 16° in the Cobb angle. Additionally, the study by GHEITASI et al. [25] highlighted the effectiveness of corrective exercises in conjunction with bracing, with a 15° reduction in the Cobb angle among patients combining both treatments. The discrepancy between these results and those of our study may be attributed to the variety of braces used and the small sample size, which limits the ability to draw robust conclusions about the effectiveness of orthopedic treatment for hyperkyphosis.

Scoliotic Posture:

Orthopedic treatment for patients with scoliotic posture in our sample focused on the use of orthopedic insoles to compensate for leg length discrepancies. Following pelvic adjustment with these insoles, patients reported significant pain relief and notable aesthetic improvement in their posture. A study by RACZKOWSKI et al. [15] also confirmed the effectiveness of these insoles in growing children with functional scoliosis, where 83.7% of patients experienced correction of their curvature after only two weeks of use, along with a reduction in back pain.

4.3.3. Evolution Under Surgical Treatment

The results of spinal arthrodesis in the scoliotic patient from our study are encouraging, with a significant reduction in the Cobb angle by 43° and a notable improvement in pain symptoms. This intervention effectively stabilized the correction, ensuring lasting results. Data from other studies, such as those by SALHI [9] and AIT CHEIHBI [8], also confirm the effectiveness of arthrodesis in reducing the Cobb angle and stabilizing postoperative scoliosis. In SALHI's study [9], the mean Cobb angle decreased by 37°, with stabilization observed in 73% of cases, while 27% experienced progression of their scoliosis after surgery. In AIT CHEIHBI's study [8], a reduction of 26° was achieved, followed by stabilization of this reduction.

5. Conclusion

Orthopedic treatment, particularly through the use of braces, has demonstrated its effectiveness in many cases, especially when initiated early and maintained consistently. However, its success is closely dependent on patient adherence, motivation, and support from their surroundings.

Rehabilitation, on the other hand, constitutes a crucial pillar in the management of spinal deviations. It offers personalized exercises aimed at strengthening the back muscles, improving posture, and relieving back pain. When combined with orthopedic treatments, it helps to slow the progression of curvatures, facilitate adaptation to braces, and enhance the quality of life for patients.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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