

Adam Gruca – precursor of the non-fusion tethering technique for idiopathic scoliosis correction (Vertebral Body Tethering)

Adam Gruca - prekursor elastycznej techniki stabilizacji kręgosłupa (Vertebral Body Tethering) w leczeniu skoliozy idiopatycznej

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EXPERT OPINION

Chir Narzadow Ruchu Ortop Pol, 2025; 90(1): 7-9

DOI: 10.31139/chnriop.2025.90.1.1

Level of evidence: V

Received: 15.01.2025

Accepted: 10.02.2025

Published: 31.03.2025

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Cite this article:

Kotwicki T. Adam Gruca – precursor of non-fusion tethering technique for idiopathic scoliosis correction (Vertebral Body Tethering). *Chir Narzadow Ruchu Ortop Pol*, 2025; 90(1): 7-9.
DOI: 10.31139/chnriop.2025.90.1.1



Abstract

Reference was made to 2 articles reprinted in No. 1/2025 of the *Chirurgia Narządów Ruchu i Ortopedia Polska – Polish Orthopaedics* describing the concept (1956) and a 3-year follow-up (1962) of correction of idiopathic scoliosis by convex interpedicular tethering with steel springs. The Polish orthopaedic surgeon Adam Gruca, the author of the technique, assumed that the springs produce a compressive force against the convexity of the curvature and applied it to the treatment of moderate flexible scolioses. Gruca liberated the convex ribs from the transverse processes at the costo-transverse and costo-vertebral joints in order to correct the rib hump by pushing it anteriorly. The spring was placed along the curve convexity in a newly created space located between the anterior aspect of the transverse processes and the corresponding rib necks. Such mechanism of scoliosis correction (Gruca “anterior interpedicular alloplasty”) seems the unique one proposed so far. The technique can be considered precursor to modern Vertebral Body Tethering (VBT).

Key words: idiopathic scoliosis, Gruca’s spring technique, Vertebral Body Tethering (VBT).

Streszczenie

Odniesiono się do 2 przedrukowanych artykułów w nr. 1/2025 *Chirurgii Narządów Ruchu i Ortopedii Polskiej* opisujących koncepcję (1956) i 3-letnią obserwację (1962) korekcji skolioz idiopatycznych poprzez kompresję wypukłej strony skoliozy za pomocą stalowych sprężyn zakładanych na nasady łuków. Polski ortopeda, Adam Gruca, autor techniki, uważał, że sprężyny wytwarzają siłę ściskającą w stosunku do wypukłości skrzywienia i stosował metodę do leczenia umiarkowanych i korektywnych skolioz. Gruca uwalniał żebra po stronie wypukłej w stawach żebrowo-poprzecznych i żebrowo-kręgowych, aby uzyskać zmniejszenie garbu żebrowego poprzez jego przesunięcie ku przodowi. Sprężynę umieszczał wzdłuż kręgosłupa, w powstałej przestrzeni pomiędzy powierzchnią przednią wyrostków poprzecznych a sztykami odpowiadających żebra. Taki mechanizm korekcji skoliozy („przednia interpedikularna alloplastyka skoliozy” wg Grucy) należy uważać za całkowicie oryginalny. Technikę można traktować jako prekursorską do współczesnej Vertebral Body Tethering (VBT).

Słowa kluczowe: skolioza idiopatyczna, sprężyny Grucy, Vertebral Body Tethering (VBT).

The Editor’s decision to present to the reader the work of Adam Gruca [1-5] about idiopathic scoliosis correction using a convex spring device seems particularly justified in the context of recent achievements in surgical correction of developmental deformities of the growing spine. The last decade has been marked by the introduction (2014) and rapid development of a non-fusion technique for scoliosis correction in children and adolescents. The term Vertebral Body Tethering (VBT) is applied to distinguish the novel correction mechanism from the well-known “non-fusion” attempts comprising multiple expandable implant systems currently in use. Originally, spinal “growing” instrumentation was initiated as a “growing” rod [6] and developed into a double growing rod, the Shilla construct

and the magnetically controlled growing rods (Magec). These systems have dominated early onset scoliosis (EOS) management for the last four decades and demonstrated moderate to fair efficacy.

Unfortunately, the initial hopes of obtaining deformity correction while maintaining vertebral mobility proved unattainable. Since the classical paper by Moe et al. [6], multiple publications have documented cases of spontaneous fusion following posterior spinal device implantation [7]. Soft tissue fibrosis followed by bony bridges resulted in the formation of a solid posterior tether, which impaired the benefits of former distraction by “diminishing returns” [8] and exposed to crankshaft deformity. Once the posterior tether has been formed

within 2-4 years following the initial surgery, these techniques proved to be neither “growth-friendly” nor “fusionless”.

The 3D analysis of progressive juvenile or adolescent idiopathic scoliosis by Dubousset et al. [9, 10, 11] pointed out the importance of balancing the anterior versus the posterior spine growth. Anterior surgery for idiopathic scoliosis proposed by Dwyer, Zielke, Hopf, and followers has never supplanted the posterior approach. Despite its proven efficacy in correcting single-level thoracolumbar or lumbar curves and limiting the extent of fusion, the anterior scoliosis correction technique’s ability to control sagittal balance has been questioned. However, in both anterior and posterior scoliosis correction, spinal fusion has remained the gold standard method to guarantee long-term stability.

The contemporary landscape of this complex issue has been reshaped by the introduction and rapid advancement of anterior scoliosis correction using the VBT system; a potentially groundbreaking, growth-friendly and fusionless procedure. Initial reports dating back 10 years [12, 13] were followed by an annual increase of about 10 PubMed publications between 2017–2020, which then rose to over 50 per year post-2020 [14, 15].

In such a context, it seems particularly justified to make the reader familiar with the achievements of Prof. Adam Gruca, performed in the fifties of the XX century in Warsaw, Poland. Two papers presented below describe the concept [1] and a 3-year-FU [5] of Gruca’s original technique of juvenile or adolescent idiopathic scoliosis correction with springs. Gruca decided to publish both papers in French

in the *Revue de Chirurgie Orthopédique et Réparatrice de l’Appareil Moteur*, testifying a close collaboration between the French and the Polish orthopaedic surgeons at the time. The solid springs produced with so-called “biological steel” could develop compression force over the curve convexity. The springs were implanted using the posterior approach. However, the compression force did not demonstrably impact the posterior aspect. Gruca’s surgical approach comprised convex ribs prominence correction by liberation of costotransverse joints and a displacement of the whole rib hump anteriorly, then by using the spring point of fixation located on the convex pedicles. The spring was placed along the curve convexity in a newly created space located between the anterior aspect of the transverse processes and the corresponding rib necks. Thus, Gruca obtained a corrective compression force at curve convexity, which was applied much more anterior than any posterior device. At the same time, it was applied slightly posteriorly compared to any anterior device. Such mechanism of scoliosis correction (“anterior interpedicular alloplasty”) seems the unique one proposed so far. Gruca’s indications concerned moderate, flexible scoliosis and were similar to contemporary VBT indications. His short and middle-term success concerned moderate thoracic and thoracolumbar curves. In a longer follow-up, the control of the growing spine proved insufficient. Gruca’s technique was used in Poland in the sixties of the XX century (Fig. 1.) up to the introduction of the Harrington rod. Nevertheless, the technique of Adam Gruca (name pronunciation: “groutza”) was probably the first to effectively correct moderate,

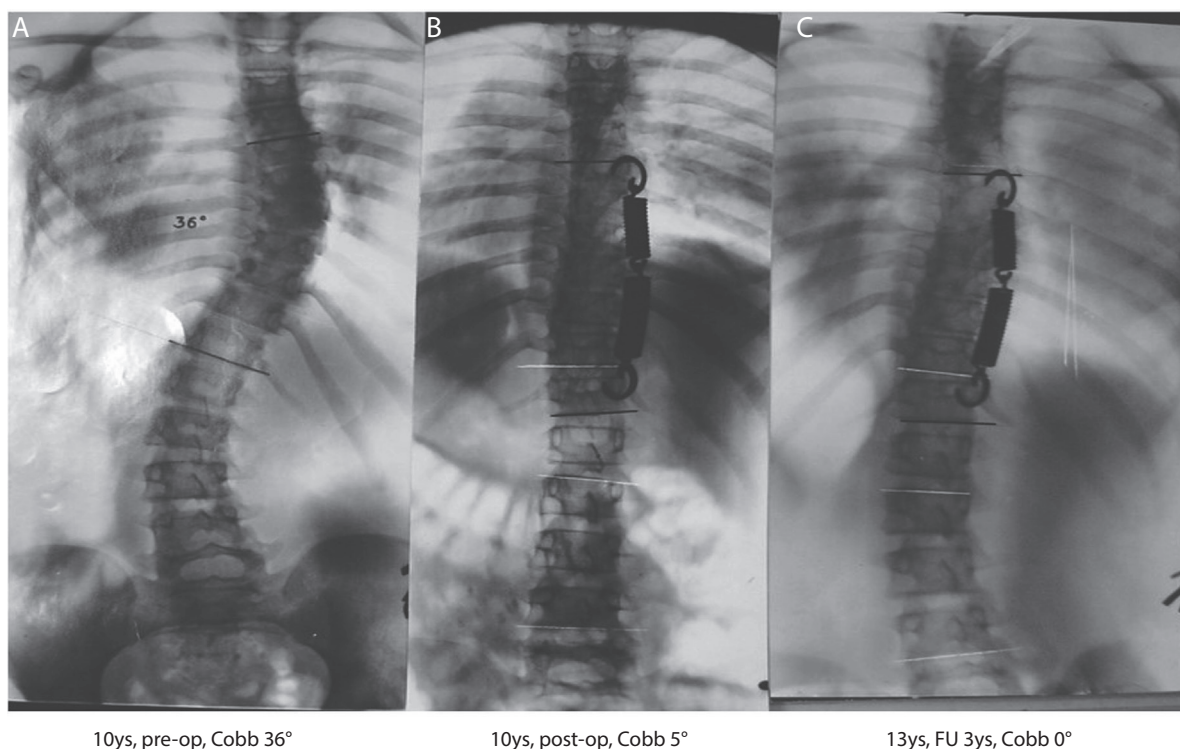


Fig. 1. Example of a 10-year-old girl with Early Onset Idiopathic Scoliosis operated on at the Department of Orthopaedics Medical Academy in Poznań, Poland according to Gruca technique in 1961. A – Preoperative radiograph. B – Early postoperative radiograph. C – Follow-up radiograph at the age of 13 years

flexible juvenile or adolescent idiopathic scoliosis by convex compression and without spine fusion. While obsolete by today's standards, his technique can be seen as a precursor of the VBT system. Adam Gruca deserves inclusion in the historical suite of eminent surgeons who anticipated trends through creative inventions in spine surgery.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Declaration of AI and AI-assisted technologies

No part of the manuscript was written by artificial intelligence.
