

NEW SPINAL INSTRUMENTATION FOR ANTERIOR STABILIZATION OF THORACOLUMBAR SPINE *

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ABSTRACT:

More and more spinal disorders require of taking over some of the spine functions by a variety of spinal implant sets and fixation devices. Beside deformations and trauma affections for which many variable instrumentation in the treatment from the posterior approach are available, still the new groups of oncological and infection diseases require of supporting the spinal functioning from the anterior surgical approach.

Apart from performing of the stabilization function the instrumentation should comply with prosthetic and corrective requirements. Both of these functions are fulfilled by the Universal System DERO where the instrumentation for the anterior and posterior surgical approach are mutually compatible. Very effective at spine correcting and stabilization is the compressive-distraction DisCom plate, which shortens significantly surgical procedure and provides the solid spine stabilization from the anterior approach at the appropriate bone structure.

Key words: Spinal Instrumentation, anterior, thoracolumbar spine.

The application of implants in the surgical treatment of deformation diseases, i.e. trauma affections and scoliosis became widespread during the last 20 years. The experiences gained at their application showed that some spine functions, as well as in many more difficult cases a decrease number of complication, may be undertaken treated by the properly selected implant sets.

Recently it has been shown, that implants may be very helpful in the treatment of fracture and other spinal disfunction of infectious, neurological and oncological origin.

Being inserted, almost in all their applications beside the anatomical features and biotolerance implants should fulfill the following functions:

1. corrective: intraoperative, postoperative in the course of therapy.
2. prosthetic: the taking over functions of the resected spinal segments
3. fixational: intraoperative, temporary, permanent.

The possibility to fulfill all functions appeared to be very difficult because of individual bone anatomy, patients age and the above mentioned type of spine disorders, as well as the extensiveness of surgery and a type of operational approach.

The correction and stabilization of thoracolumbar segment of spine from the posterior approach with the

use of implants such as hook and transpedicular screw, which are being attached to bone, have been widely accepted in surgical practice (1).

A list of instrumentations which are used for spine fixation from the anterior approach is much shorter. During the recent years the instrumentations such as: Zielke, CD-Danek, Depuy-Motech, BWM, Kaneda, MOSS, etc. have been developed (2). Regarding the movement of the sensitive internal organs it is required to apply implants of thin and rounded shape while using the instrumentation from the anterior approach. Most of the applied constructions are based on the application of the carrying elements, being usually a rods or a plate, which in both cases are fastened directly or indirectly to spinal vertebra by screws.

Much progress in the stabilization of spine from the anterior approach was the proposition to use Z-Plate-ATL. For the safe operation performance the complete set of 9 plates of length from 5 to 13 cm, every 1 cm, was constructed: Fig. 1.

The mutual localization of the circular hole makes it impossible, in mechanical respect, to take full advantage of frontal areas of vertebrae. From biomechanical investigations it is well known that mounting the screws at the opposite frontal areas of vertebra body enables to carry the highest distraction-compression loads. When mounting the screws in the middle of the vertebra body at large loads the process of mechanical "ploughing" or lysis and consequently screws loosening in the vertebra body may occur. In case of the uniform plate the construction significantly

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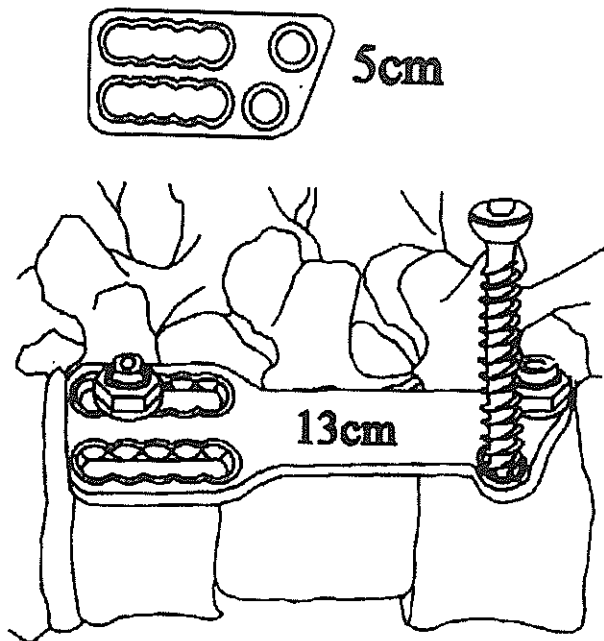


Fig. 1: Shortest (5 cm) and longest (13 cm)
Z Platte - ALT from DANEK

limitates and makes difficult the linear correction i.e. the distraction-compression, which is very often necessary to be applied in the spine treatment (3, 4).

Correction and stabilization of spine in DERO System. Known spinal instrumentations are developed either as universal which enable.

a) the long and short-segment stabilization from both the anterior and posterior approach, or,

b) as the very specialistic instrumentations designed to the treatment of the selected spine segments for the patient of the particular age and one or at least few spinal diseases. The examples of the first type of instrumentation may be TSRH-Danek and SOCON-Aesculap.

Universal Spinal System DERO was developed, which provides the possibility to treat the patients of any age in any spine segment, to treat different spinal diseases from both the anterior and posterior approach.

The construction of DERO is based on the system of the carrying spinal rod, hooks, transpedicular and body screws which serve as the elements woining bone (spine) with the carrying beam as well as the other direct elements which support and strengthen the whole stabilization set (5).

DisCom: distraction-compression plate. The assistance of th spinal treatment from anterior ap-

proach with the application of DERO implants brings the possibility of their easy setting-up into any required correctional and stabilizational system in respect of physiology and uses best properties of bone-implant nodes.

In order to obtain the proper stabilization from the anterior approach and to easy the peroperational distraction and compression with regard to physiological curvatures of thoraco-lumbar spine the Spinal System DERO was supplemented in a new sliding plate called DisCom.

In fig. 2 the complete set of DisCom plates -left and right- was shown: left - universal permanent sliding plate with two bone screws of a diameter 7 mm. right - matched to the length of being stabilized spine segment the inserted plate with two bone screws of diameter 7 mm.

DisCom System consisted of A B i C plates gives the possibility of distraction and compression in range between $\Delta L = \pm 10$ mm, while the system which includes D and E plates gives additionally the possibility of shaping the inner plate along the plate plane or/and in perpendicular direction assuring also the adaptation of plate to spine curvature.

Table 1 lists the ranges of DisCom plates length, were: *LR- the length of treated spine segment which function is undertaken by DisCom plate (it is often the length of the resected body vertebra) ranging 27 to 77 mm; *LO- the overall length of DisCom plate; ranging from 90 to 140 mm.

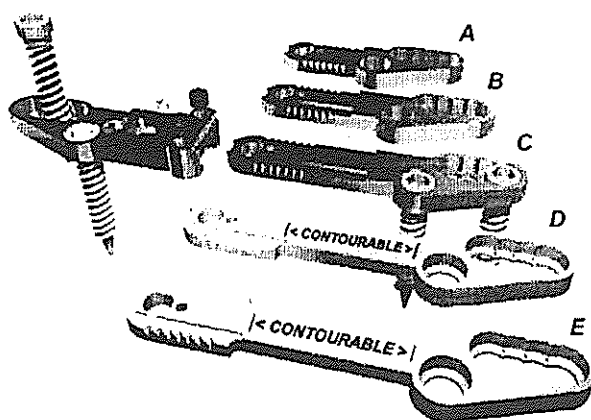
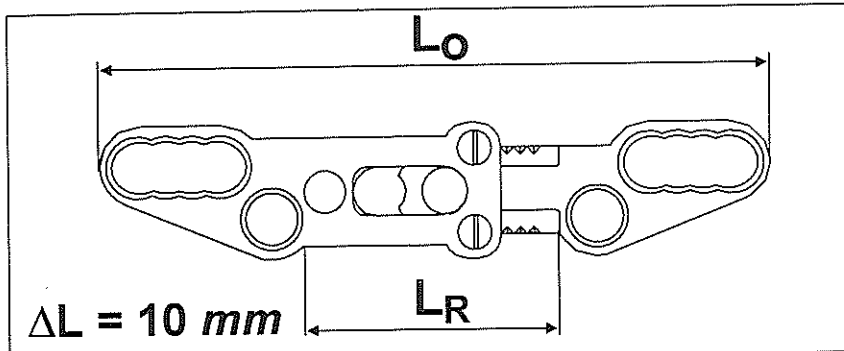


Fig. 2: DisCom: distracto-compressional plate A..E with contourable plates D and E for correction and stabilization of spine from anterior approach

Table 1: Inner and outer length - range of DisCom for A...E set of plates



set of plates	L_R [mm]	L_O [mm]
A	27 - 37	90 - 100
B	37 - 47	100 - 110
C	47 - 57	110 - 120
D*	57 - 67	120 - 130
E*	67 - 77	130 - 140

* D, E - contourable plates

The maximal and minimal L_O and L_R lengths show that DisCom plate is designed for the stabilization covering from three to four - five six thoracolumbar vertebrae.

An enormous advantage of DisCom set is the possibility to perform the distraction and compression at unloading and to insert, a prosthesis of resected bodies. The distraction and compression are performed by the plate which is attached to vertebra body with a help of a spreader with the special tips (Fig. 3), being mounted in technological holes of every DisCom plate. The stabilization is obtained by tightening up two, conically shaped, blocking screws.

The surgical practice has given the evidence that DisCom is particularly useful at the treatment of spinal diseases which are associated with a resection and a replacement of vertebra bodies by metallic prosthesis. In Fig. 4 the main steps of operational procedure at applying of DisCom in the treatment of diseases in which the resection of vertebra is necessary, are presented. Based on a computer animation of spine stabilization with the use of DisCom plate, these proce-

dures have been implemented and verified in surgical practice.

In Fig. 5 a, postoperational X-ray after resection of L2 vertebra is presented. The resected L2 vertebra was replaced by the perforated cylindrical metallic prosthesis filled with bone and stabilized by the DisCom plate.

DISCUSSION

Some spinal deformations, especially these which result from oncological and infection diseases require the correction and stabilization from the anterior approach. In many cases during the treatment of these disorders the peroperational correction is preceded by the resection of spinal segments and the application of a prosthesis, i.e. for example a perforated cylindrical mesh. The carrying construction elements of the stabilization system which replace

the resected vertebra, are rest on a structural component formed by a rod or a plate. The application of rod is very advantageous regarding the easy possibility their matching in situ to physiological curvatures,

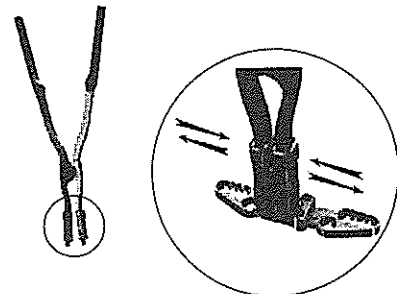


Figure 3: Distraction and compression with DisCom plate using technological holes and standard DERO System spreader

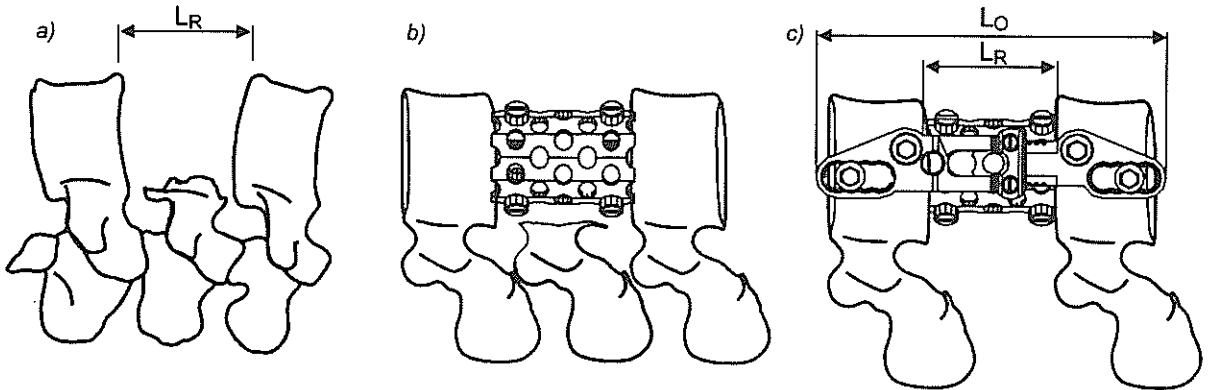


Figure 4: Some steps of operational procedure with DisCom fixation and cylindrical perforated prosthesis inserting after resection of vertebral body: a) resection of vertebral body, b) inserting of perforated cylinder, c) fixation of DisCom plate

while the stabilization itself is not always sufficient in respect of its strength and requires usually the additional stabilization from the posterior approach.

Very effective, particularly in cases which require the peroperational correction, is the application of a plate stable element, which at the proper bone structure gives a solid stabilization supported on two screws being tightened through the plate into the healthy vertebra. The distraction-compression DisCom plate gives such the possibilities and is particularly useful for the stabilization surgery by the resection of destroyed vertebra body and its replacing with metallic prosthesis.

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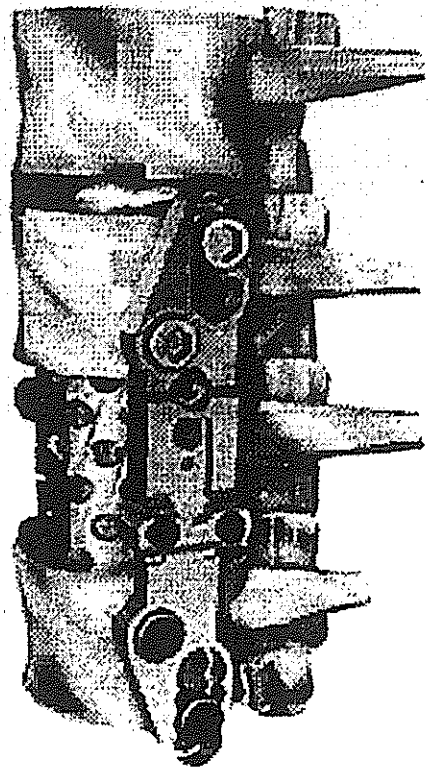


Figure 5. Resection of oncological L2, inserting of perforated cylindrical prosthesis and fixation with DisCom from anterior approach (A, B) adequate view in computer simulating (C).

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