ADVANTAGES OF INTERNAL FIXATOR IN SHORT SEGMENTED VERTEBRAE FRACTURE CAUSING KYPHOSIS DEFORMITY

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The advantages of using internal fixator to other types of osteosynthesis instruments is dedected. Ability to correct kyphosis and making distraction properties of internal fixator are the factors that provide the superiority of it.

It is possible to restore the kyphosis by corrective distraction with axial rotation of rods which are necessarily curved and montaged. But during this rotation pressure of rods to the fractured posterior elements of vertebrae is unavoidable. In addition if the hooks proximal and distal to the fracture are single the rotation will have no effect of correcting the kyphosis. By using internal fixator the restoration of deformity easily be done with the lever arm system and without pressure to the posterior fractured elements.

In modern surgery, especially in orthopaedics, different osteosynthesis materials have been developed and began to be used recently. It is also possible to see these similar developements in spine surgery. With the recent advances, indications for spine surgery have also broadened. Different instrumentations are aimed for use in the same principle: to achieve adequate reduction and maintain this correction.

It is found more logical to use different appropriate instrumentation in different vertebral pathologies, instead of using the same instrumentation on every case. With the same sense, it is necessary to use the most appropriate instrumentation for the short segmented compression fractures distal to thoracal tenth vertebrae.

Fig. 1:

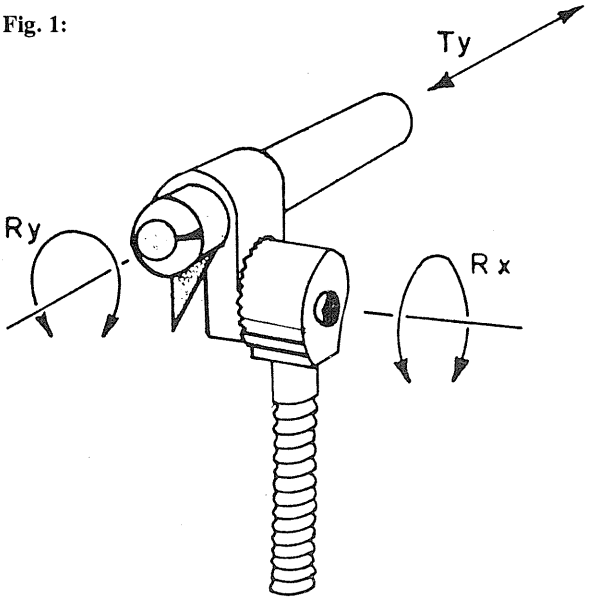
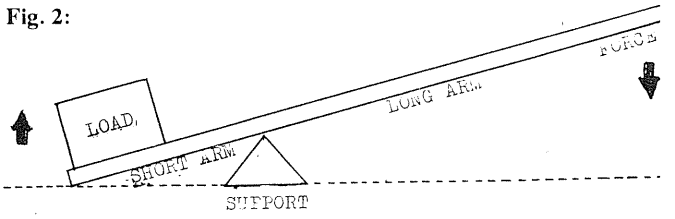


Fig. 2:



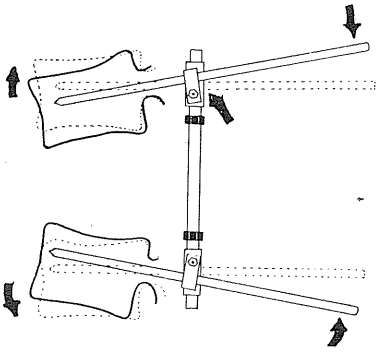


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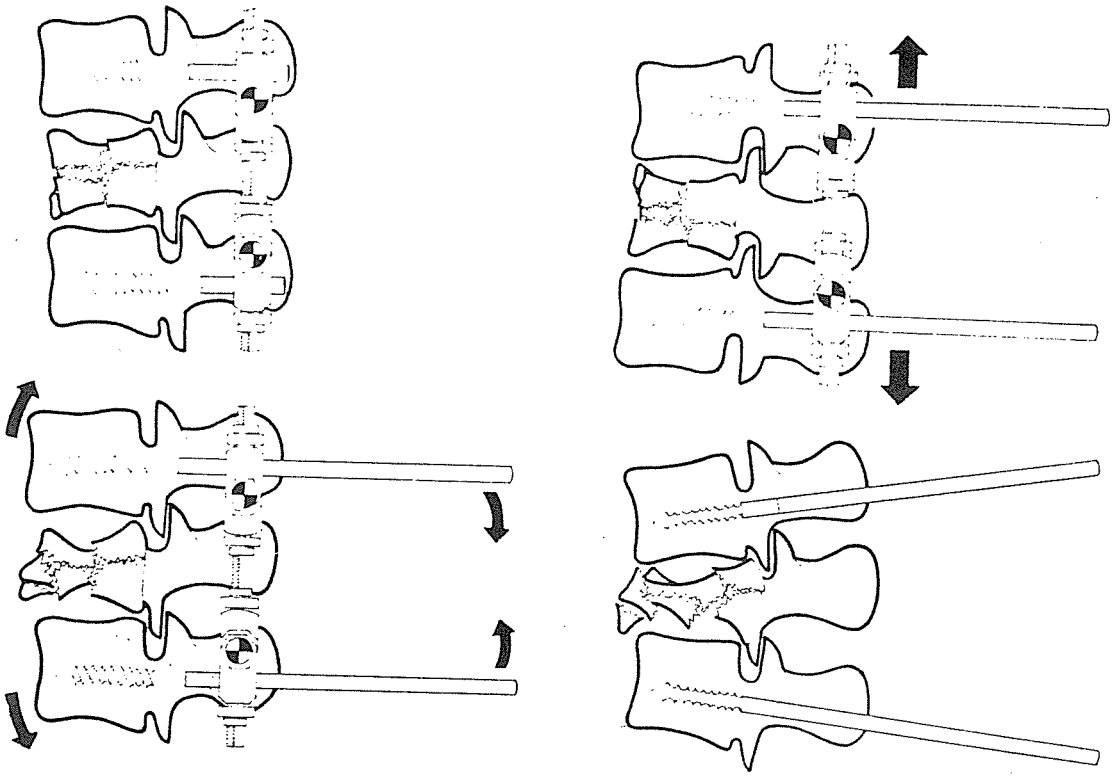
Fig. 3:



Significant improvemants remains possible in the designe of surgical implants for posterior spinal stabilisation to be used for dealing with single motion segment instability in short segmented vertebrae fracture causing kyphotic deformity below tenth thoracal, thoraco-lombar and lombar vertebral level.

In modern surgery, to provide a three dimensional correction is essential. Dimensions to be corrected are axial rotation, deviations to the sides and pathological deviations in A-P directions. This principle is valid for scoliotic deformity. ın short segmented vertebrae corpus compression fracture, there is also three dimensions to be corrected. These dimensions to be corrected (3-D) are, correction of kyphotic deformity caused by loss of height of vertebrae corpus, restoration of vertebral height and lateral curves (Fig.1).

In the experimental laboratory work, it is aimed to study the corrective effects of various osteosynthesis materials that can be used in vertebrae corpus fractures. Corrective mechanisms of all tyne internal fixators which can move in both, sagital and longitudinal directions, and other osteosynthesis materials are compared to provide 3-D correction.

We think that, the main advantage of internal fixator is the ability of correcting the kyphosis and distraction. Also with other instrumentation it is possible to make distraction and correct kyphotic deformity, but it is necessery to make different manipulations for this purpose.

First, the basic techniques of instrumentation for internal fixator and other systems are mentioned below.

In internal fixator, first uninvolved vertebraes just proximal and distal are hold by transpedicular Shanz screws to the anterior wall of the corpus vertebrae. Two rods which lay on the back side aspect of the vertebrae are conected to the clamp through which the Shanz screws pass through, connected to the second clamp. First clamp moves in upward and downward direction on the rods. Second clamp controls the Shanz screws. Two clamps are fixed to each other by bolts and nuts. Second clamp ensures movement of Shanz

Fig. 4-A, 4-B:

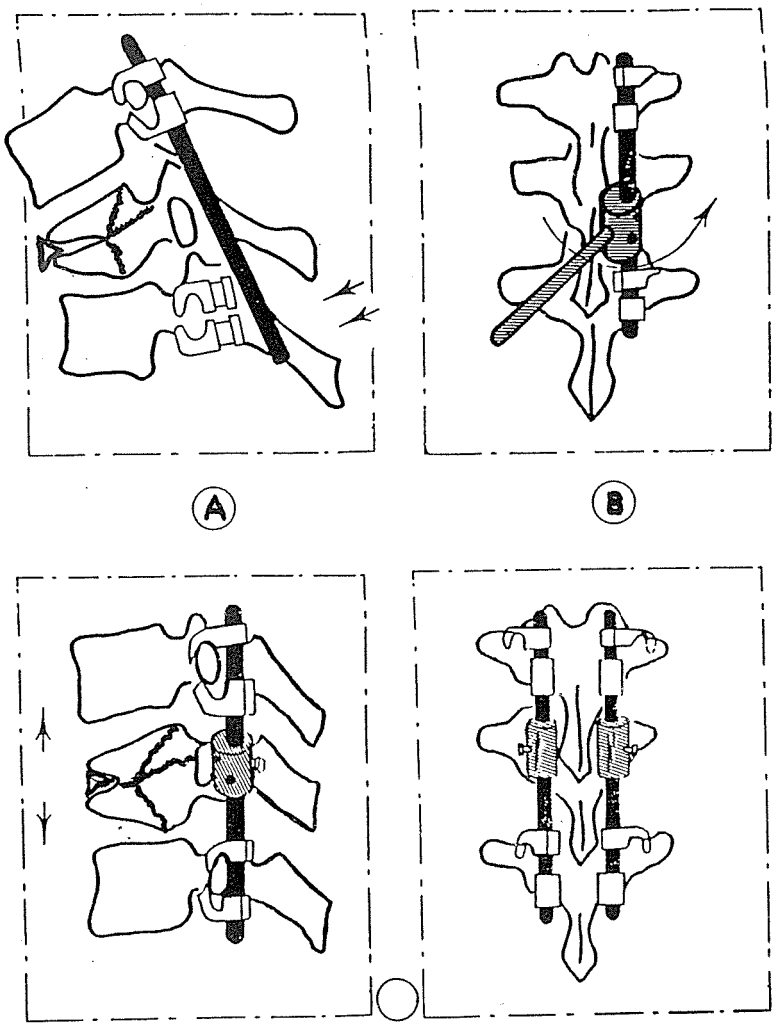
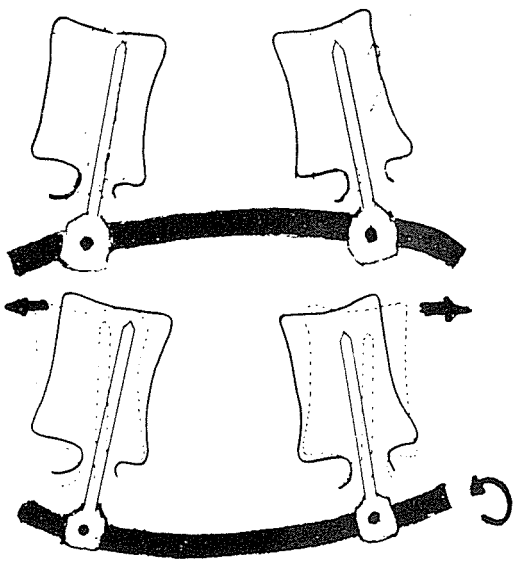


Fig. 5:



screws in sagittal direction. Compression and distraction is provided by the first clamp, while movement of the Shanz screws is enabled by the second clamp. Shanz screws connected to the second clamp, correct kyphosis by the lever arm system. The supporting point to the lever arm are the clamps connected on the rods (Fig. 2). Shorter lever arms are the screws lying from the clamp to the anterior wall of the vertebrae. Longer arms are the Shanz screws which lie outside.

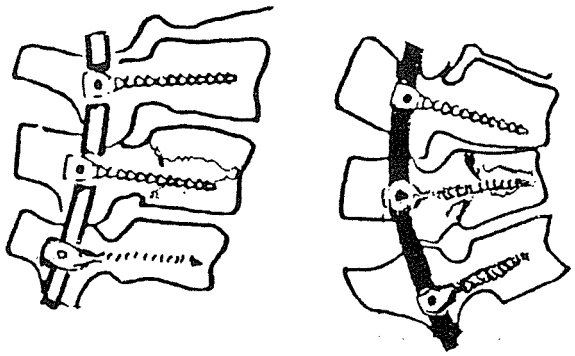
By force to longer lever arm, loads which are vertebraes can be lifted. After the restoration of kyphosis second clamp is fixed to the first clamp. Then to restore the height of vertebraes, distraction is applied and first clamp is also fixed to the rods (Fig.3).

In the second group of systems the instrumentation is as follows. Similarly screws are applied transpedicularly. Rod is applied to the opening on these screws. Like internal fixator, it is possible to make distraction or compression. Since there is no longer lever arm, it is difficult to correct kyphosis. Stiff rod screw connection prevents the movements of transpedicular screws. In order to correct kyphosis by these systems the first way is to bend the rods, applying, rotation like the corrective manipulation for scoliotic deormity. The second way is applying first Shanz screw to the rod, correct the kyphotic deformity like in Harrington system and apply the second Shanz screw to the rod (Fig. 4-A). The third way is the correction of the kyphosis by a eccentric cylinder applicated to the apical kyphotic area (Fig. 4-B).

In the first way, rotation of the rod may be inadequate, especially when the kyposis angle is small, as the rod is not locked during manipulation it tends to move upwads and downwards direction in its opening on the screw (Fig. 5). Because the proximal and distal vertebraes are not effected by the rotation of the bending rod kyphosis can not be corrected.

When the kyphosis angle is great, as

Fig. 6:



the apex of the bending rod moves forword by rotation, it tends to compress the posterior elements. When the posterior elements are intact, this movement may not cause any problem. But in case of fracture, due to pressure in posterior elements, this rotation may cause spinal injuries. When the fractured vertebrae pedicule is intact howewer, the transpedicular screw applied in this le-vel, due 3 points mechanism correct kyphosis by rotation (Fig. 6).

During the manipulation of rotation, it is possible to prevent proximal and distal movement of the rod in pedicular screws. When the rod is fixed in upward and downward direction, axial rotation of the rod is prevented. If rod is fixed, distal to the proximal screw and proximal to the distal screw, it is possible to correct kyphosis. But it should be remembered that, distraction done to restore height may cause loosening and loss of kyphotic angle correction.

In the second and third ways to correct kyphosis reduction is risky due to the possibility of medullar compression as the support for the lever arm are the posterior elements of fractured vertebrae.

As a result, it is possible to use several osteosynthesis materials for the short segmented kyphotic deformities due to vertebral body collapse. For the correction of kyphosis, most practical and less risky materials seems to be the internal fixators due to their clamps having the ability to move separately from each other in different direction, axially and sagitally. Other systems of instrumentation have been tried for the correction of short segmented kyphosis due to the fracture. But the same degree of correction as in internal fixator have not been obtained.

1. Only 3 vertebrae are spanned (in Harrington system 5-7 vert)
2. True 3 dimensionel fixations are done,
3. There is no penetration of materials into the spinal canal like Luque wires or Harrington hooks,
4. Attachements of Shanz screws in pedicle are firme and rigid. Our selected group of patients show the advantages of internal fixators to other system of instrumentation.

REFERENCES

1. Bradford, D.S., Akbarnia, B.A., Winter, B., "Surgical Stabilisation of Fracture Dislocation of The Toracic Spine" Spine 2 185 1977.
2. Cotrel, Y., Dubousset, J., Guillaumat, M. "New Instrumentation for surgery of the spine" Freund Publishing House England 1986.
3. Dick, W. "Internal Fixation of Thoracic and Lumbar Spine Fractures" Hans Huber Publishers Stuttgart 1989.
4. Dickson, J., Harrington, P.R., Erwin, W.D. "Results of reduction and Stabilisation of The Severely Fractured Thoracic and Lumbar Spine" J. Bone Joint Surg. 60-A 1978.
5. Gertzbein, S.D., Macmichael, D., Tile, M. "Harrington Instrumentation as a Method of Fixation in Fractures of The Spine. J: Bone Joint Surg. 64-B 1982.
6. Jacobs, R.R., Nordwall, A., Nachemson, A.L. "Reduction, Stability and Strength Provided by Internal Fixation Systems for Thoraco-lumbar Spinal Injuries" Clinical Orthop. 171. 1982.
7. Krag, M.H., Beynnon, B.D., Pope M., Frymoyer. J.W., Haugh, L.D., Weaver, D.L. "An Internal Fixator For Posterior application To Short Segments of The Thoracic, Lumbar or Lumbosacral Spine" Design and Testing Clinical Orthop. 203, 75-98 1986.
8. Luque, E., Cassis, N., Ramirez-Wiella, G. "Segmental Spinal Instrumentation in The Treatment of Fractures of The Toracolumbar Spine" Spine 7, 312 1982.
9. Magerl, F. "External Skletal Fixation of The Lower Thoracic and The Lumbar Spine" Current Concept of External Fixation of Fractures H.K. (Ed) 355-366 Springer, Berlin, Heidelberg 1982.
10. McAffi, P.C., Bohlman, H.H "Complications Following Harrington Instrumentation for Fractures of The Thoracolumbar Spine" J. Bone Joint Surg. 67-A 1985.
11. Schlapfer, F., Wördsdörfer, O., Magerl, F., Perren, S.M. "Stabilisation of the Lower Thoracic and Lumbar Spine: comparative in vitro investigation of an external skletal and various Internal fixation devices" Current Concept of external fixation of fractures H.K. (ed) 367 Springer, Berlin Heidelberg 1982.
12. Stauffer, E.S. "Current concept review. Internal fixation of thoraco lumbar spine fractures. J Bone Joint Surg. 66-A 1984.