Dear colleges! I would like to present an Ilizarov Hexapod Apparatus .

The Hexapod represents the kinematic mechanism that realizes the three dimensional movements by different lengths of the six distractors connected to the two platforms. It's well known in technique and uses for imitation of flying and other machines.

The system has been developed in Germany and first presented at the Ilizarov meeting in Hamburg in 1995 by Dr. K. Seide and prof. Wolter.

The Hexapos set for Ilizarov apparatus consists of six telescopic distraction rods of varying length from 105-240 mm, 6 Y-adaptors, a measuring stick and the software.

| 6 telescopic distraction rods	6 Y - adaptors	Software	Measuring stick

The Y- adaptors can be utilized with all types of the Ilizarov rings. It is possible to place the adaptors freely along the rings as necessary. The connection between the Y- adaptors and the distraction rods is through a universal ball and socket joint.
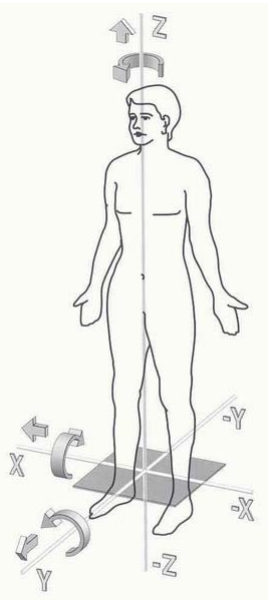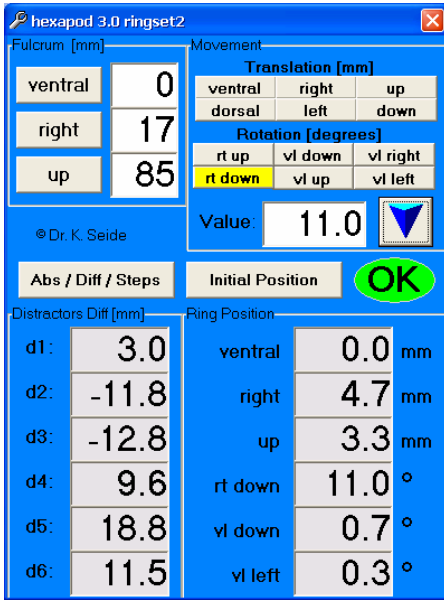

The software is very simple to use and does not need any connection to the Internet. The base data needed includes the diameter of the upper and lower rings, the positions of the Y adaptors on each ring and the length of the distraction rods. After the input of this data into the computer, the program shows the initial position of center of the upper ring in relation to the lower.
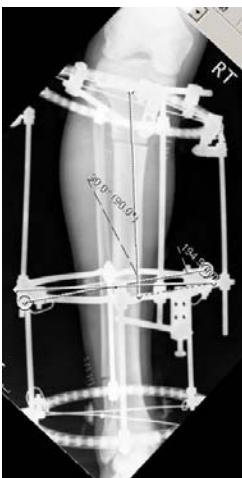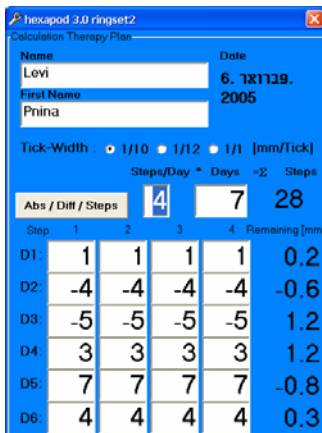

From this point, all adjustments are made with specific reference to the central point of the lower ring, since this ring remains in a static position. All adjustments can be in three planes. The CORA is entered in relation to the center of the distal ring and the desired correction entered into the computer.

hexapod 3.0 ringset2

Fulcrum [mm]
ventral 0
right 17
up 85

© Dr. K. Seide

Abs / Diff / Steps

Movement
Translation [mm]
ventral | right | up
dorsal | left | down
Rotation [degrees]
rt up | vl down | vl right
rt down | vl up | vl left

Value: 11.0 ▼

Initial Position OK

Distractors Diff [mm] — Ring Position

d1:	3.0	ventral	0.0 mm
d2:	-11.8	right	4.7 mm
d3:	-12.8	up	3.3 mm
d4:	9.6	rt down	11.0 °
d5:	18.8	vl down	0.7 °
d6:	11.5	vl left	0.3 °

The software then makes the appropriate adjustments for deformity correction consistently for each plane according to the plan developed on the basis of the malalignment test along three axes with six degrees of freedom.

hexapod 3.0 ringset2

Calculation Therapy Plan

Name: Levi
First Name: Pnina
Date: 6. פברואר 2005

Tick-Width: ● 1/10 ○ 1/12 ○ 1/1 [mm/Tick]

Steps/Day * Days =Σ Steps

Abs / Diff / Steps   4   7   28

| Step | 1 | 2 | 3 | 4 | Remaining [mm] |
D1:	1	1	1	1	0.2
D2:	-4	-4	-4	-4	-0.6
D3:	-5	-5	-5	-5	1.2
D4:	3	3	3	3	1.2
D5:	7	7	7	7	-0.8
D6:	4	4	4	4	0.3

The software displays a plan for correction detailing the steps according to the surgeons input of the number of days and steps desired. The numbers on the slide enumerates the number of clicks on each specific distractor necessary to obtain the desired correction. Each click is a 0.1mm length of distractor.

hexapod 3.0 ringset2

Upper Ring
Diameter: 200
Pos. D6-D1: 53
Pos. D2-D3: 15
Pos. D4-D5: 34

Lower Ring
Diameter: 180
Pos. D1-D2: 5
Pos. D3-D4: 24
Pos. D5-D6: 40

Abs / Diff / Steps   Initial Position   !

Distractors Abs [mm] — Ring Position

| D1: | 146.0 | dorsal | 8.4 mm |
D2:	145.2	right	2.2 mm
D3:	133.2	up	111.2 mm
D4:	170.6	rt down	19.4 °
D5:	183.8	vl down	2.1 °
D6:	176.5	vl right	3.4 °

Beyond this, the software determines the final length of the distractors and the changes between the rings so that the progress and changes can be monitored to assure that the changes have occurred appropriately along the scheduled plan.

There is no necessity to establish Hexapod in operation room, it application and removal is quick, taking only about fifteen minutes for each procedure, and is pain-free.
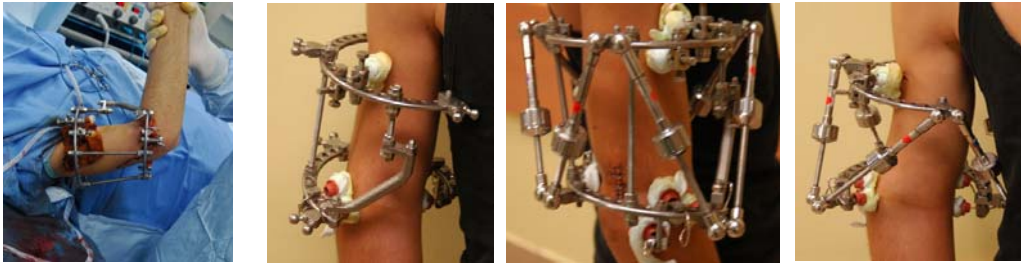
After removal, it is possible to put it to the following patient, thus, having 3-4 Hexapod sets it is possible to treat consistently big number of patients. I, for example for a year having 2 sets, have applied them 21 times.
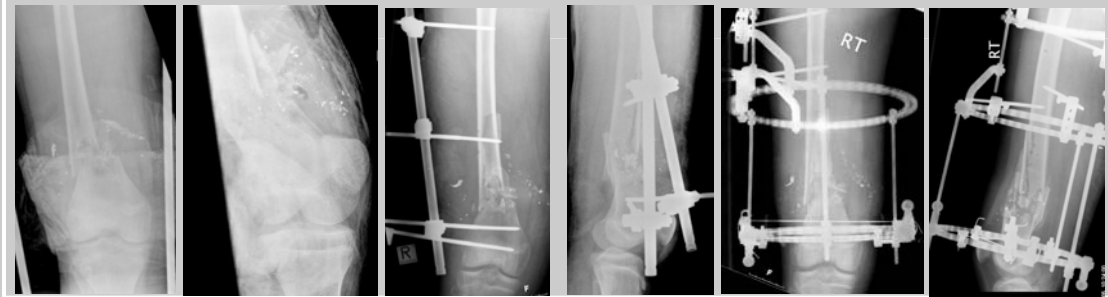
There are X-Rays of a thirteen year old boy with a comminuted distal femur fracture secondary to a gunshot wound, initially treated with an AO external fixator. The alignment was unacceptable and an Ilizarov external fixator was applied three weeks after the injury. No attempt of definitive reduction was made during the surgery.

The Hexapod set was applied for ten days and acceptable reduction was received.

When reduction was finished, the Hexapod set was removed and further management has been continued by standard Ilizarov regime. Good anatomic and functional results were achieved.
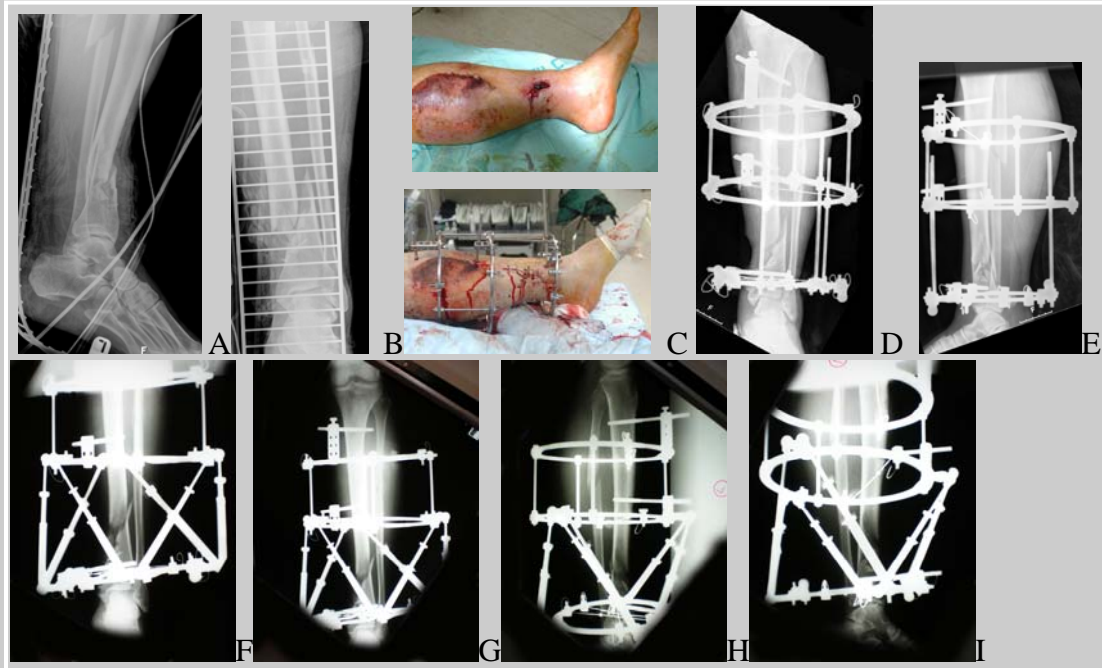
Fig.5 X-rays of Compound Comminuted # Distal/3 Lt Tibia (**A, B**). In operation room before and after Ilizarov apparatus has been applied (**C**) Postoperative X-rays (**D, E**) And final reduction after Hexapod program has been finished (**F – I**)
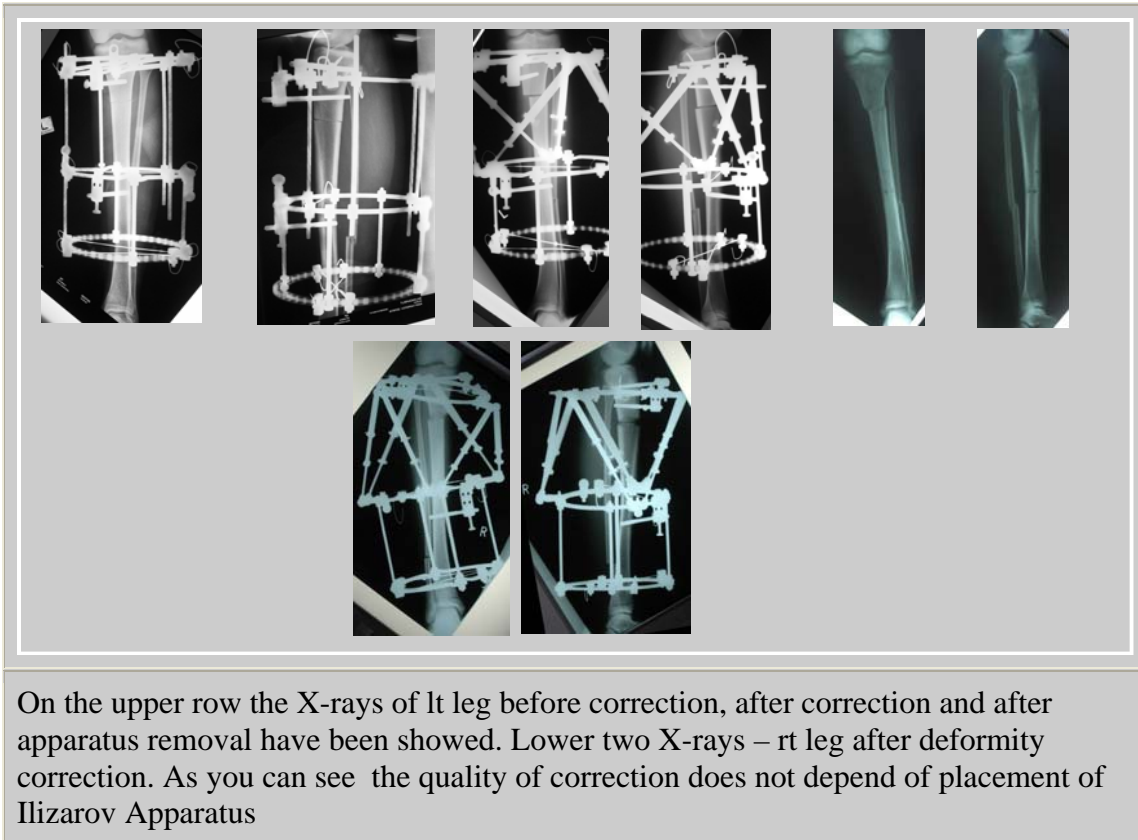
Simultaneous and exact correction of multilane deformities combined with rotation is very important and difficult to accept at application of Ilizarov apparatus. In these cases Ilizarov hexapod
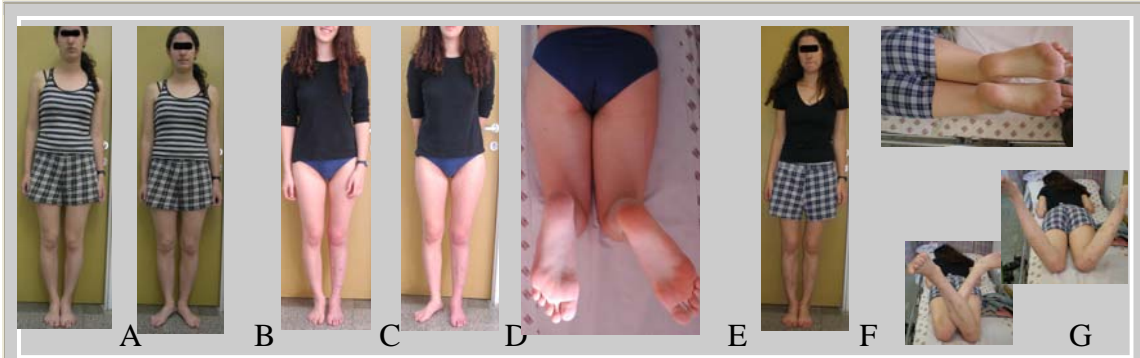
Before treatment (**A, B**) After derotation osteotomy of lt femur and tibia (**C-E**) The final result after derotation osteotomies of rt femur and tibia.(F,G)

apparatus is irreplaceable.

The above figure shows pictures and x-rays of 21 y.o. female with bilateral external tibial torsion.

On the upper row the X-rays of lt leg before correction, after correction and after apparatus removal have been showed. Lower two X-rays – rt leg after deformity correction. As you can see the quality of correction does not depend of placement of Ilizarov Apparatus

The addition of the Hexapod set to standard Ilizarov fixator preserves the independence and universality of the original system while enabling precision accurate corrections of deformity through its software support. It is simple, easy and economically effective. And I recommend it for use very much.

Odessky Jacob M.D.