

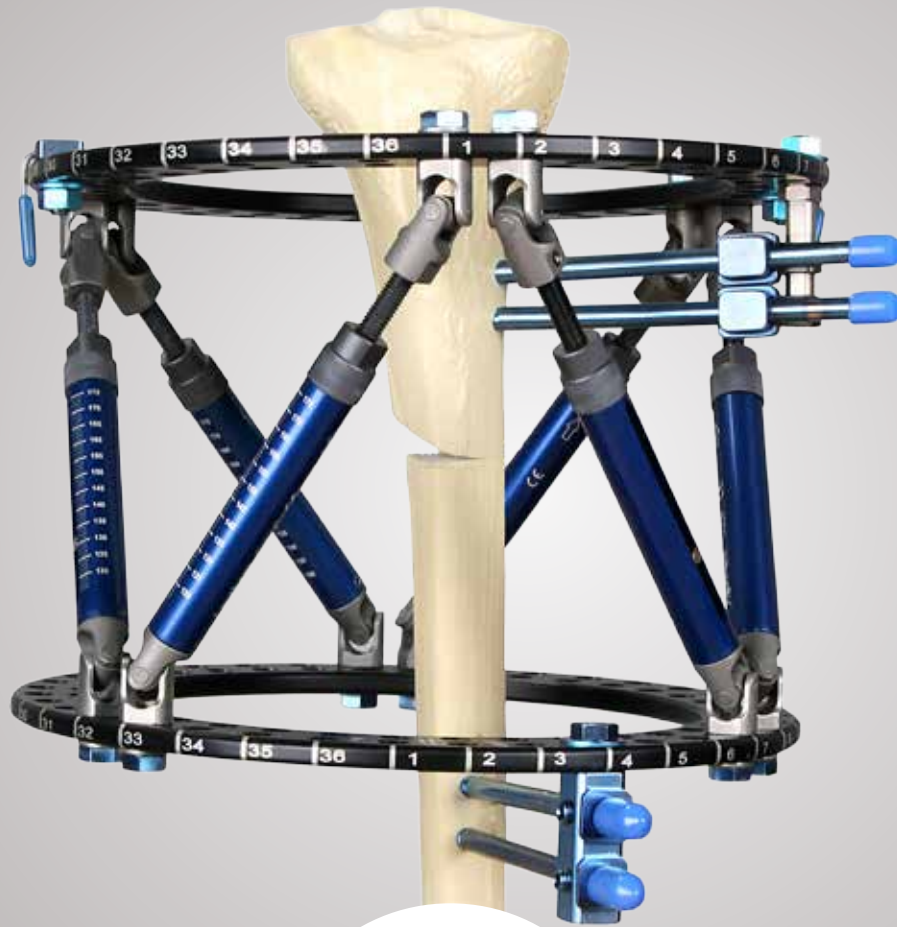
Smart Correction[®]

Computer Assisted
Hexapod Ring
External Fixator System



smart correction[®]

Computer-Assisted Hexapod Ring External Fixator System



Smart Correction



The Smart Correction® Computer-Assisted Circular Hexapod External Fixator System is a copyrighted software based, deformity correction and fracture reduction tool. This hexapod and ring external fixator, provides easy application, high mechanical stability and precise correction via web based software with radiographic navigation.

The Smart Correction® System is designed for the treatment of open and closed fractures, limb lengthening, non-unions, malunions and pseudoarthrosis of long bones. The computer assisted planning and correction provides accurate movement in all planes, coupled with easy application and high mechanical stability.

The basic system is comprised of two rings or partial rings, combined with six struts. The system is augmented by easy to use web-based software with Radiographic Navigation which provides a schedule detailing the necessary strut adjustments needed to achieve the chosen deformity correction.

Web based easy to use unique software with radiographic navigation capability facilitates deformity correction in all geometric planes (axial, frontal, coronal, translational).

The advanced material technology employed in the manufacture of the Smart Correction® components make the system strong, but lightweight, enhancing patient comfort.

The composite rings, titanium wires, pins and screws improve clarity of X-ray and Magnetic Resonance Imaging.

Advanced Wire and Screw Clamp

Provide desired screw and wire position on the rings, through fully adjustable wire and screw height angles.



Telescopic Strut

Manufactured from Titanium and Aluminium offering lightweight frame composition. There are two strut option with Smart Correction, Universal Joint and VariJoint Struts. The Express Strut option provides the acute correction and fixes the adjusted position by the safe threaded locking mechanism.

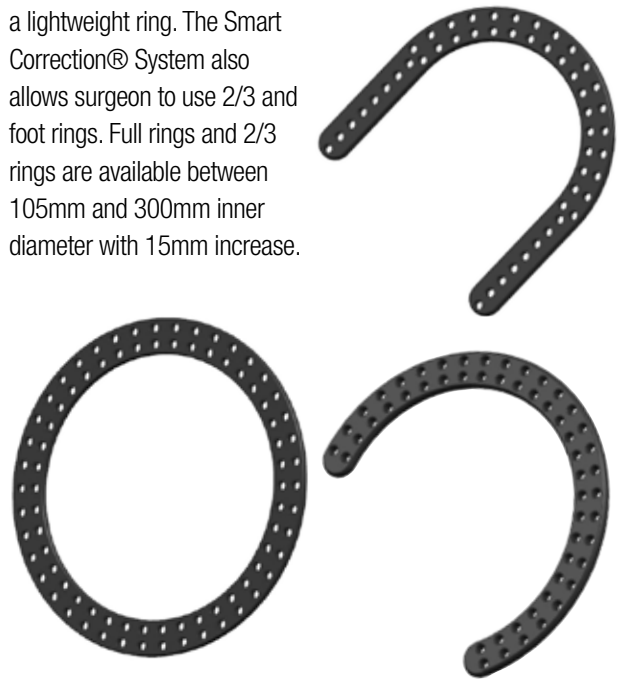


Strut Type	Range (mm)
Dual Joint Strut, Extra Extra Short (XXS)	55 65
Dual Joint Strut, Extra Extra Short (XS)	60 75
Dual Joint Strut, Extra Short (S)	75 95
Dual Joint Strut, Short (S)	90 125
Dual Joint Strut, Medium (M)	115 175
Dual Joint Strut, Long (L)	165 275
Dual Joint Strut, Extra Long (XL)	265 475
Dual Joint Express Strut, Extra Extra Short (XXS)	80 95
Dual Joint Express Strut, Extra Short (XS)	95 115
Dual Joint Express Strut, Short (S)	110 145
Dual Joint Express Strut, Medium (M)	135 195
Dual Joint Express Strut, Long (L)	185 295
Dual Joint Express Strut, Extra Long (XL)	285 495

Dual Hole Ring

Aluminium and Carbon Fiber rings with double parallel sets of holes offer optimal positioning of wire and pin clamps in

a lightweight ring. The Smart Correction® System also allows surgeon to use 2/3 and foot rings. Full rings and 2/3 rings are available between 105mm and 300mm inner diameter with 15mm increase.



Bone Screw

Manufactured in both Titanium and Stainless Steel, conical screw design provides optimal bone purchase. Available in both trocar and blunt point tip and HA coated and non-coated.

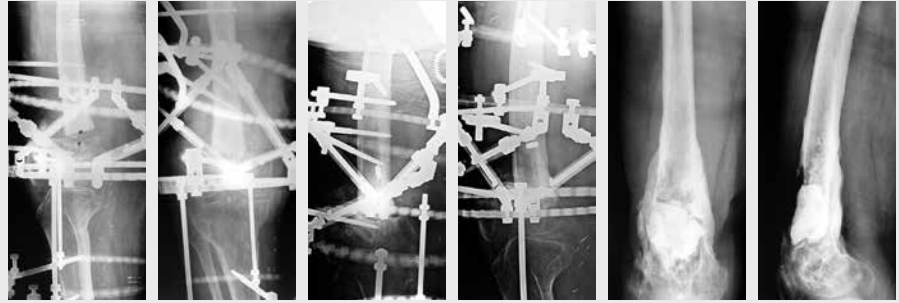


Accurate User Friendly Software

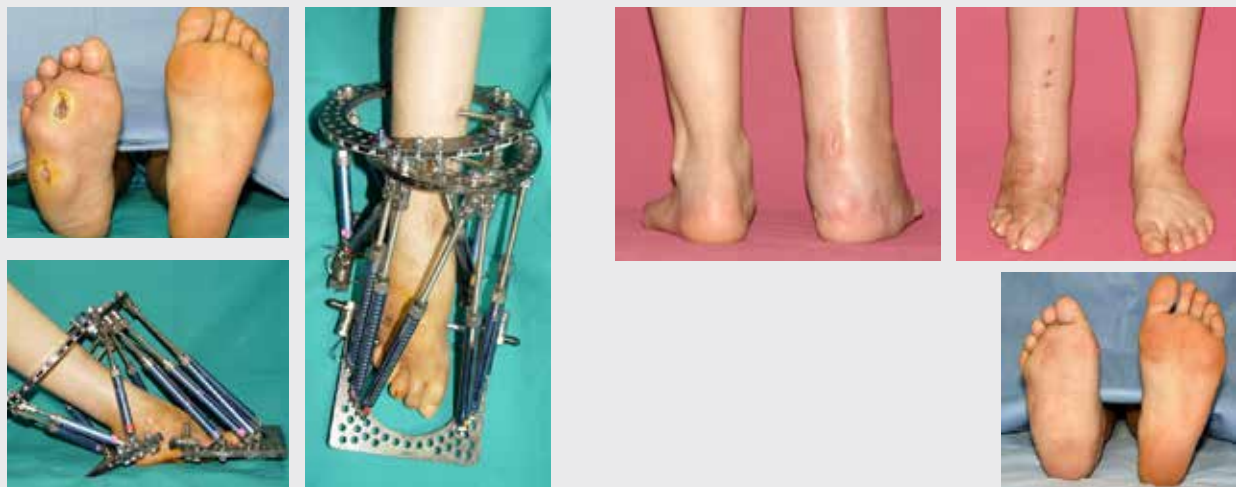
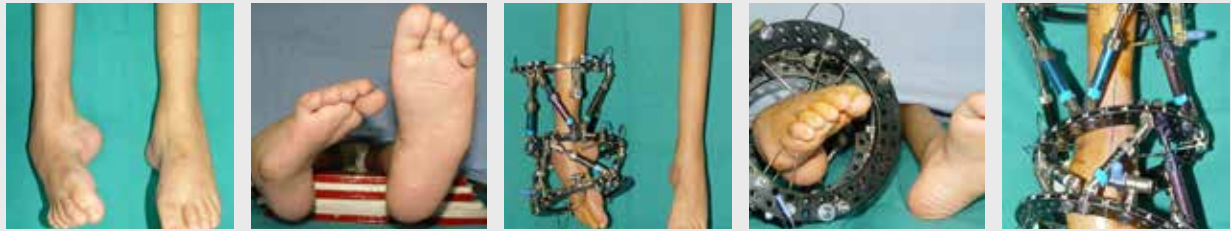
Provides an accurate deformity correction schedule for the patient and surgeon, which is kept on file and can be reviewed and modified at any point in the correction procedure. Due to the complex algorithm behind the web interface, surgeon does not need to spend unnecessarily effort to record the patient&frame details and prepare the correction prescription for the patient.



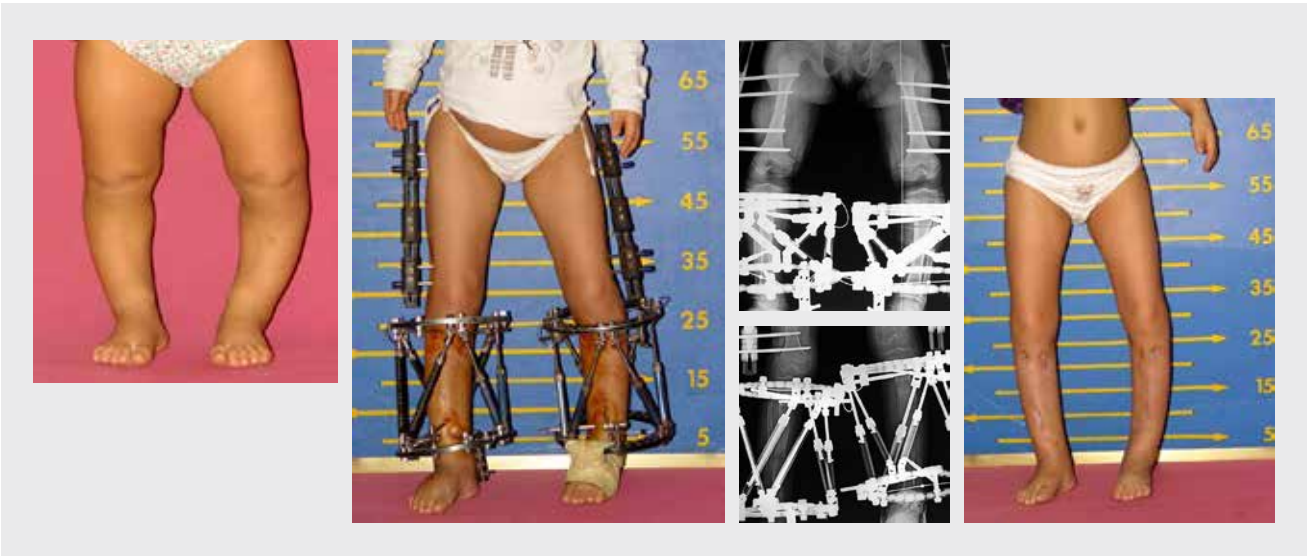
Case Examples



Case Examples



Case Examples



Frame Assembly

Positioning of the Proximal Ring

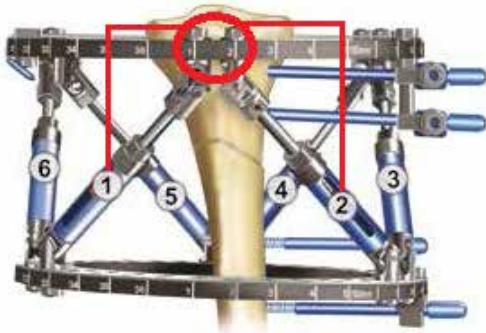
The appropriate sized ring should be chosen to avoid ring contact with the skin both initially and during the correctional procedure. The rings have two concentric hole series. When constructing the fixator the outer holes must be used for the strut connections.

Position the proximal ring, such that the fixation hole marked with no. 1 is placed as approximately Anterior to the bone as possible in the Sagittal plane. In general the ring is placed perpendicular (at 90°) to the long axis of the bone (in this example the proximal tibia), although this is not an absolute requirement.

Following local clinical protocol attach the ring to the Proximal bone fragment using suitable Smart Correction® external fixation wires and half pins.

First Two Struts Position (Strut 1 & Strut 2)

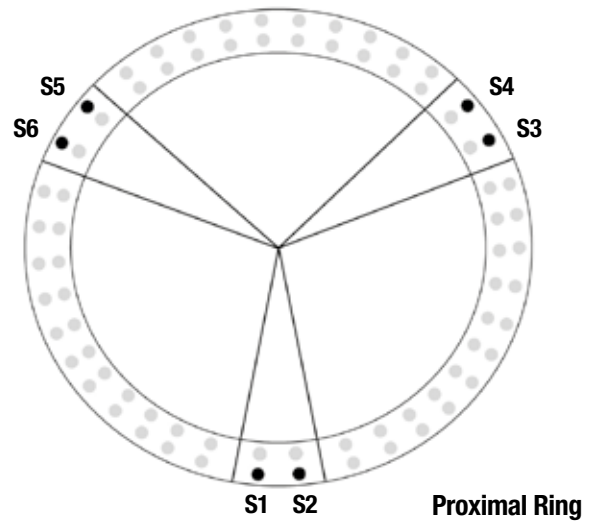
Fix the first strut (Strut 1) into the hole no. 1 and second strut (Strut 2) into the hole no.2 in the Proximal ring. This is the recommended ideal position although the system allows for the changes of strut positions on the rings as per the table below. Between 2 and 3 empty holes may be left between consecutive strut positions.



Strut 3-4 and Strut 5-6

The remaining struts are placed in pairs approximately equidistant around the circumference of the ring. In the 39 hole ring (165mm) example below strut 3 and 4 are fitted to holes no.14 and no.15, while struts 5 and 6 are attached at holes no.27 and no.28. However, due to the advanced nature of the system this position is not an absolute requirement. The Smart Correction® offers the surgeon the flexibility to place the struts anywhere within a range of holes. The diagram and table illustrate the acceptable range of holes for each ring size.

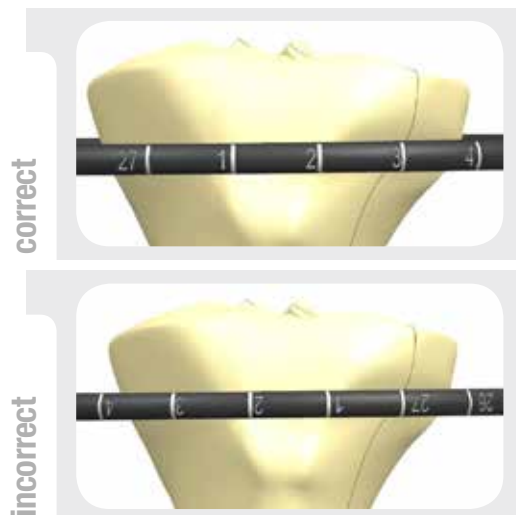
Ring 1 Size	Ideal Position Strut 3&4	Ideal position Strut 5&6	Acceptable Tolerance
105mm	10&11	19&20	±2 holes
120 mm	11&12	21&22	±2 holes
135mm	12&13	23&24	±2 holes
150mm	13&14	25&26	±2 holes
165mm	14&15	27&28	±3 holes
180mm	15&16	29&30	±3 holes
195mm	16&17	31&32	±4 holes
210mm	17&18	33&34	±4 holes
225mm	18&19	35&36	±4 holes



Positioning of the Distal Ring

The Distal ring numbering should be aligned as parallel as possible to the Proximal ring.

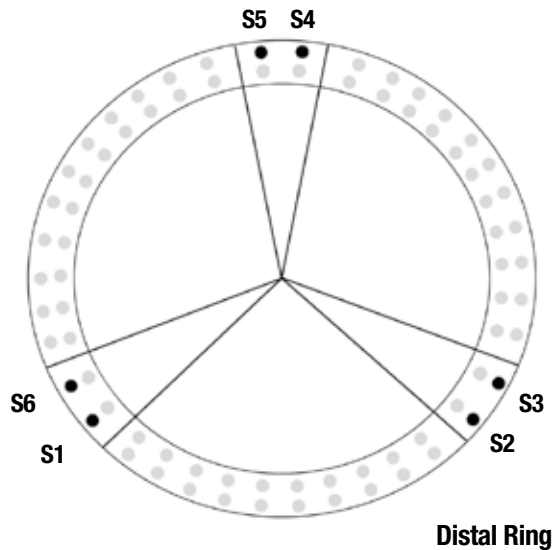
The ring numbers should stay as below and do not need to be reverse.



Strut Attachment on the Distal Ring

The struts are now fixed on the distal ring in pairs, in this case struts 2 & 3, struts 4 & 5 and struts 6 & 1. Ideally the pairs of struts should be attached at adjacent holes, however due to the advanced design of the Smart Correction® System the strut pairs can be separated by up to two or three ring holes. Similarly, the ideal position of the strut pairs is equidistant around the distal ring also. On a standard 39 hole example ring (165mm) this would be position no.7 & no.8 for strut 2 & 3, position no.20 & no.21 with struts 4 & 5 and finally position no.32 & no.33 with strut 6 & 1. The table below shows the optional range of holes on the second ring for each ring size.

Ring 1 Size	Ideal Position Strut 2&3	Ideal Position Strut 4&5	Ideal Position Strut 6&1	Acceptable Tolerance
105mm	25&6	7&15	16&24	±2 holes
120mm	6&7	16&17	26&27	±2 holes
135mm	6&7	17&18	28&29	±2 holes
150mm	7&8	19&20	31&32	±2 holes
165mm	7&8	20&21	32&33	±3 holes
180mm	8&9	22&23	36&37	±3 holes
195mm	9&10	24&25	39&40	±4 holes
210mm	9&10	25&26	41&42	±4 holes
225mm	45&10	11&27	28&44	±4 holes



Advanced Capabilities

In addition to full ring construction, the Smart Correction® System allows 2/3rd rings and foot rings to be used, enhancing patient comfort.

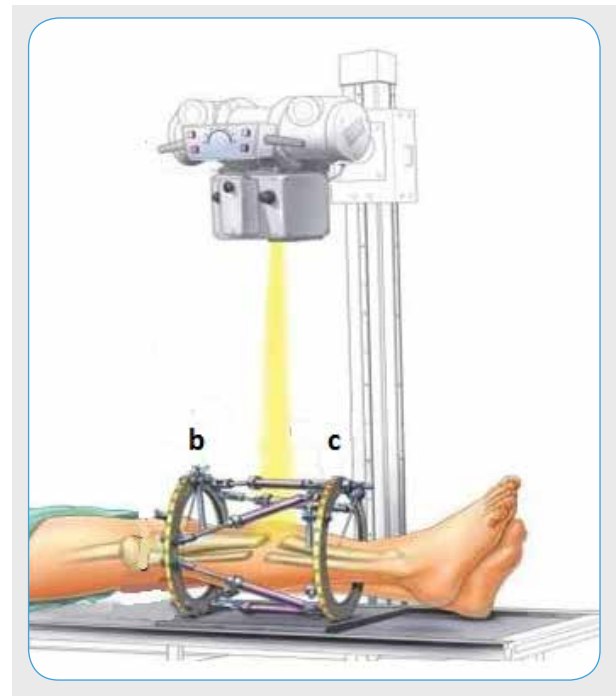


Recording Frame Details

Post-operatively the orientation of the frame, the position of the struts and the ring sizes need to be recorded on the Patient Data Form (can be downloaded from the web site).

X-Ray Parameters

The surgeon is required to obtain a post-operative radiography and record the following parameters in both the Frontal and Lateral Plane. The Radiant Point for the x-ray machine should be centralised over the mid-point of the frame. The distance between x-ray source and x-ray film can be between 600mm to 1500mm.



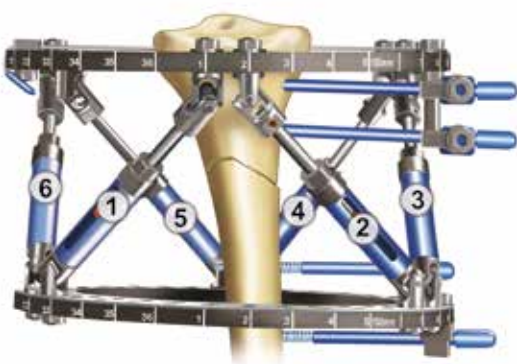
- (b) Nearest point to the x-ray source on the Proximal ring.
- (c) Nearest point to the x-ray source on the Distal ring.
- (d) Clearance of Proximal Ring from x-ray film (mm)
- (e) Clearance of Distal Ring from x-ray film (mm)

NOTE: The radiographs do not need to be taken from absolute Anterior and Lateral views. A close approximation will be sufficient.

Recording Ring and Strut Size

There are nine different ring diameters available ranging from 105mm to 225mm, and six strut lengths (XXShort, XShort, Short, Medium, Long and X Long). Each pair of holes in the ring is numbered, in order for the system to be able to provide a precise deformity correction protocol. The position and size of each strut and the size of the rings needs to be recorded. Any combination of ring and strut size may be used relevant to the deformity and patient requirements.

The sizes and position of the rings and struts used are recorded on the Smart Correction® Patient Data Form either during the procedure or postoperatively.

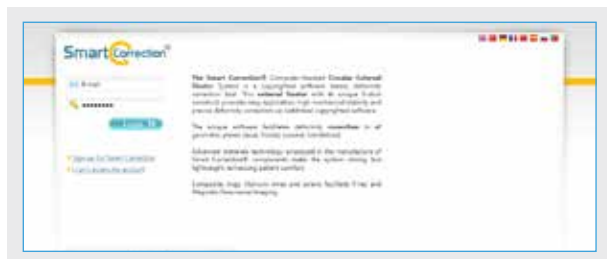


Web-Based Deformity Correction Software with Radiographic Navigation

Smart Correction® fixator components only form one half of the system. The second part of the system consists of the copyrighted web-based software with radiographic navigation, which calculates the schedule of frame adjustments to be carried out during the post-operative treatment in order to achieve the deformity correction.

Software Access

In order to access the web site, all users need to complete a registration process prior to use. Please go to **www.smartcorrection.com** to register. The user will be assigned a Password and Username (e-mail address), which will be confirmed, via e-mail.



Software Instructions

Log-In and Welcome Page

Following entry of your Username and Password, the Welcome Screen appears. Select the "Patient" tab on the top of the page. This allows the surgeon to review the records and cases for each patient, track correction, and undertake on-screen searches, facilitating easier clinical follow-up. The surgeon also has access to review, amend, revise or create new Patient Records.



New Patient Record

To create a new Patient Record select the "New" button or click on the patient name to add or see cases.



Complete the Patient Details as appropriate



Patient Records

Each patient can have several different cases held under their Patient Record, including revisions.

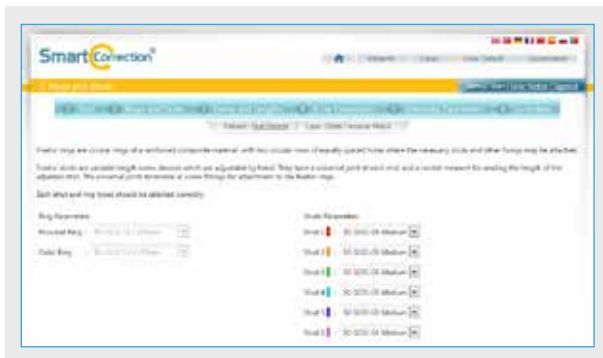
To create a new case for the selected patient, select the "New" button or click on the recorded cases to work on. The "extremity side" field is very important for the correction of rotational deformities and need to be selected carefully.



Data Entry

Ring and Strut Selection

Select the Ring and Strut tab, and select the corresponding ring and strut sizes as recorded in the Patient Data Form.



Strut Position and Length Data Entry

Select the Frame and Length tab. Enter each strut fixation hole number for both of the proximal and distal ring and each strut length as recorded on the Patient Data Form.



Model Creation

After the strut lengths and strut hole numbers have been entered the software then creates a frame model and shows both a Frontal and Lateral view.



X-Ray parameters

Select the X-Ray parameters tab. Enter the data from Patient Data Form for parameter (b) and (c), for the Frontal and Lateral X-rays. If one or both of the rings are not able to touch the x-ray film, the space between ring(s) and x-ray film need to be measured and need to be entered for parameter (d) and (e) The recommended distance between x-ray source and x-ray film is between 600mm and 1500mm.



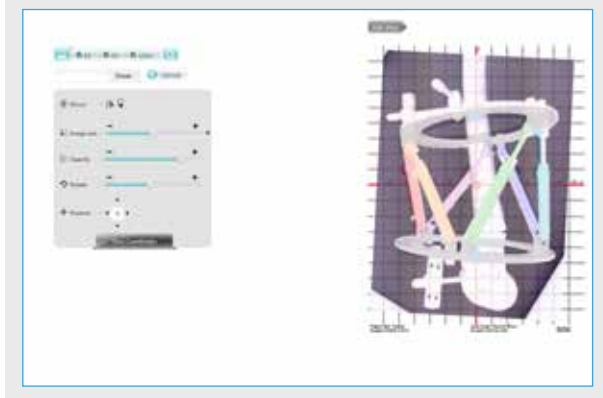
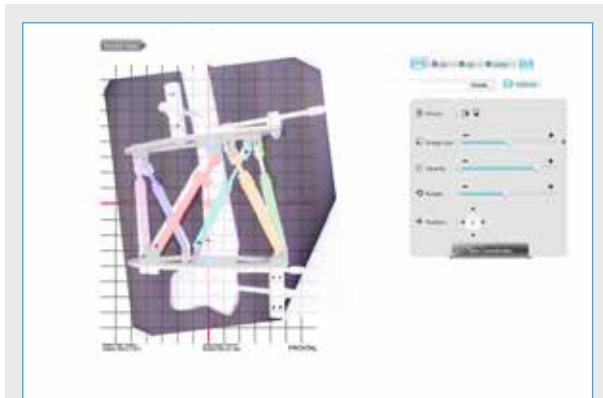
X-Ray image uploading and overlaying the template

After software generates the gridlined template, the patient radiographs will need to be uploaded to the software. Select the appropriate image file by clicking on “Browse” and choosing the image file corresponding to the A/P view. JPEG, PNG, BMP formats are acceptable.

NOTE: the screen may darken slightly as the data is transmitted.

Once the screen brightens again the orientation of the radiograph can be adjusted to match the gridline image. This is achieved by adjusting a combination of the Rotation, Position, Image Size and Opacity. Once the radiograph of the frame has been aligned to the virtual frame on the gridmap image the user should click on the “Save Coordinate” button. This locks the image in the adjusted position.

The same steps are repeated for the Lateral image. Then select “Save” and “Next Step” buttons to proceed to the Deformity Parameters page.



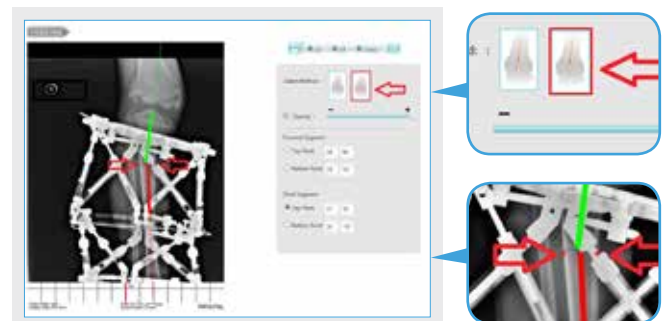
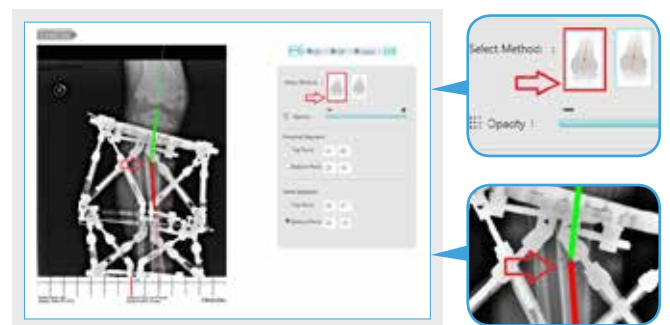
Bone Segments Mapping

The surgeon is now required to locate the proximal and distal axis of each bone segment on both the Frontal and Lateral Views.

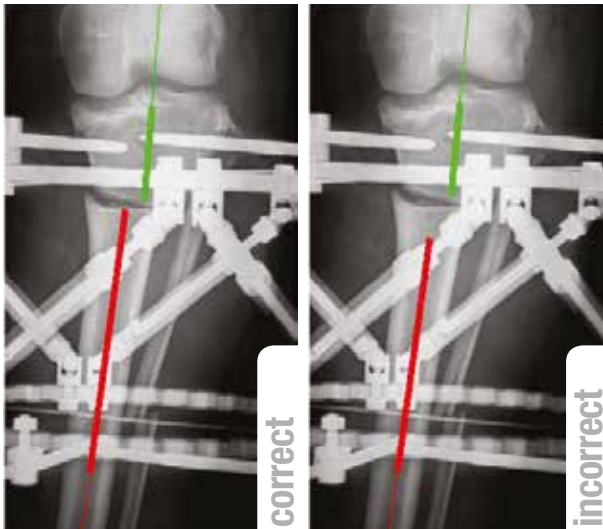


Select the “Proximal Segment - Top Point” from the list, using the pointer, selecting the point on the radiograph corresponding to this description. The bone axis should be marked via mid-diaphyseal points. .

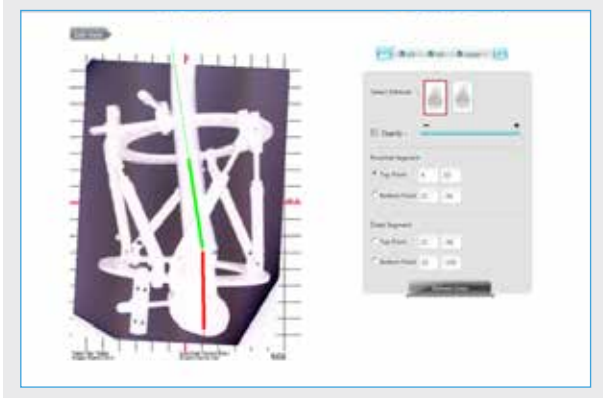
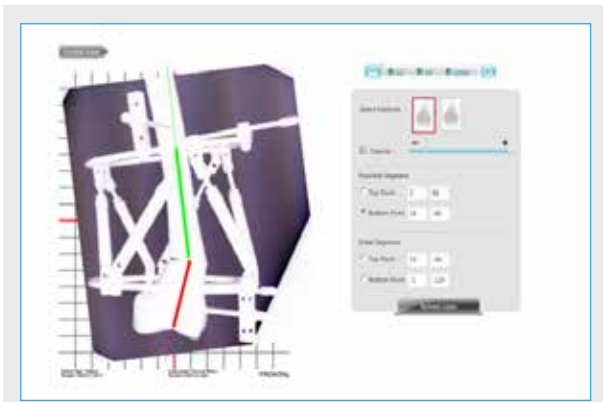
There are two options available to find the mid-diaphyseal point on the x-ray images. The first option is to click on the mid-diaphyseal point directly. The second option is to click on both cortices of the bone on the radiographs. The software will then calculates the midpoint.



NOTE: The software will programme the frame adjustment schedule to bring the two fragment sections together through compression/distraction with concomitant discomfort and pain. The amount of compression/distraction can be determined and controlled by the positioning of these segments.



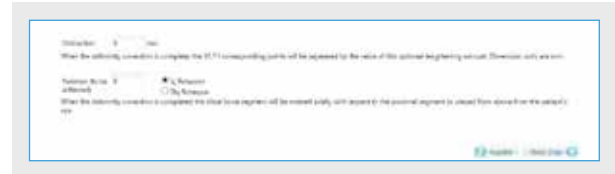
Repeat this step for the “Distal Segment” of the Frontal view and both Proximal-Distal segments on Lateral View X-Ray image.



Distraction and Rotation

At this point the amount of desired lengthening or compression (mm) and rotation (degrees) will need to be entered.

When the deformity correction is completed, the distal bone segment (ring) will be rotated axially with respect to the proximal segment as viewed from above from the patient’s eyes.



After the bone segments mapping and Distraction/Rotation parameters, the surgeon should now save the data by clicking the “Save” button.

Note: This may take a short while the information is uploaded to the Smart Correction site.

Once the surgeon is satisfied that all parameters are correct, press “Save”, and then “Next Step”.

Deformity Correction Schedule

Select the “Correction Tab”. Enter the starting date for Callus distraction and the total correction period. The software will then generate the strut length adjustment schedule and an animation will start to show the fixator motion during the correction period in days. Bone segments movement per day will be written under the schedule table.

Then this can be e-mailed to the patient from the system, along with consultation dates chosen by the surgeon. The patient's e-mail address should be entered during the patient details data entry. This page also shows the possible dates for strut changes along with the necessary strut size changes.

Day	Size	Start	End	Start	End	Start	End
0	16000002 Fix	138 mm	138 mm	140 mm	138 mm	138 mm	138 mm
1	16000002 Fix	137 mm	138 mm	140 mm	137 mm	137 mm	137 mm
2	07000002 Hex	138 mm	138 mm	140 mm	137 mm	137 mm	137 mm
3	16000002 Fix	136 mm	138 mm	138 mm	136 mm	136 mm	136 mm
4	16000002 Fix	135 mm	137 mm	138 mm	135 mm	135 mm	135 mm
5	16000002 Fix	142 mm	137 mm	138 mm	142 mm	138 mm	137 mm
6	16000002 Fix	140 mm	137 mm	137 mm	140 mm	137 mm	137 mm
7	16000002 Hex	138 mm	137 mm	137 mm	138 mm	137 mm	137 mm

Strut Replacement

During the course of treatment struts may need to be changed to accommodate changes in ring distances. This is indicated within the correction schedule. Where longer struts are required, they are highlighted in “Yellow”. When shorter struts are required, they are highlighted in “Blue” as shown above.

NOTE : When changing struts, remember to set the replacement strut length at the same value as the strut being removed.

Revision

In order to revise or change any parameters within the Patient Record, select the “Revision” button. The “Revision” button appears on the screen of “6. Correction” and “1. Start” tab. Once the revised data has been entered into the Patient Record, select the “Calculate” & “Save Case”. This will overwrite the data in that Patient Record.

The “Revision” process adjusts the strut as the lengths at the chosen revision day.

Smart Correction Aluminium Rings

50-1012-10A	Dual Hole Full Ring, 105mm inner diameter, Aluminium
50-1012-12A	Dual Hole Full Ring, 120mm inner diameter, Aluminium
50-1012-13A	Dual Hole Full Ring, 135mm inner diameter, Aluminium
50-1012-15A	Dual Hole Full Ring, 150mm inner diameter, Aluminium
50-1012-16A	Dual Hole Full Ring, 165mm inner diameter, Aluminium
50-1012-18A	Dual Hole Full Ring, 180mm inner diameter, Aluminium
50-1012-19A	Dual Hole Full Ring, 195mm inner diameter, Aluminium
50-1012-21A	Dual Hole Full Ring, 210mm inner diameter, Aluminium
50-1012-22A	Dual Hole Full Ring, 225mm inner diameter, Aluminium
50-1012-24A	Dual Hole Full Ring, 240mm inner diameter, Aluminium
50-1012-25A	Dual Hole Full Ring, 255mm inner diameter, Aluminium
50-1012-27A	Dual Hole Full Ring, 270mm inner diameter, Aluminium
50-1012-28A	Dual Hole Full Ring, 285mm inner diameter, Aluminium
50-1012-30A	Dual Hole Full Ring, 300mm inner diameter, Aluminium
50-1017-10A	Dual Hole 2/3 Ring, 105mm inner diameter, Aluminium
50-1017-12A	Dual Hole 2/3 Ring, 120mm inner diameter, Aluminium
50-1017-13A	Dual Hole 2/3 Ring, 135mm inner diameter, Aluminium
50-1017-15A	Dual Hole 2/3 Ring, 150mm inner diameter, Aluminium
50-1017-16A	Dual Hole 2/3 Ring, 165mm inner diameter, Aluminium
50-1017-18A	Dual Hole 2/3 Ring, 180mm inner diameter, Aluminium
50-1017-19A	Dual Hole 2/3 Ring, 195mm inner diameter, Aluminium
50-1017-21A	Dual Hole 2/3 Ring, 210mm inner diameter, Aluminium
50-1017-22A	Dual Hole 2/3 Ring, 225mm inner diameter, Aluminium
50-1017-24A	Dual Hole 2/3 Ring, 240mm inner diameter, Aluminium
50-1017-25A	Dual Hole 2/3 Ring, 255mm inner diameter, Aluminium
50-1017-27A	Dual Hole 2/3 Ring, 270mm inner diameter, Aluminium
50-1017-28A	Dual Hole 2/3 Ring, 285mm inner diameter, Aluminium
50-1017-30A	Dual Hole 2/3 Ring, 300mm inner diameter, Aluminium



Smart Correction Carbon Composite Rings

50-1012-10C	Dual Hole Full Ring, 105mm inner diameter, Carbon Composite
50-1012-12C	Dual Hole Full Ring, 120mm inner diameter, Carbon Composite
50-1012-13C	Dual Hole Full Ring, 135mm inner diameter, Carbon Composite
50-1012-15C	Dual Hole Full Ring, 150mm inner diameter, Carbon Composite
50-1012-16C	Dual Hole Full Ring, 165mm inner diameter, Carbon Composite
50-1012-18C	Dual Hole Full Ring, 180mm inner diameter, Carbon Composite
50-1012-19C	Dual Hole Full Ring, 195mm inner diameter, Carbon Composite
50-1012-21C	Dual Hole Full Ring, 210mm inner diameter, Carbon Composite
50-1012-22C	Dual Hole Full Ring, 225mm inner diameter, Carbon Composite
50-1012-24C	Dual Hole Full Ring, 240mm inner diameter, Carbon Composite
50-1012-25C	Dual Hole Full Ring, 255mm inner diameter, Carbon Composite
50-1012-27C	Dual Hole Full Ring, 270mm inner diameter, Carbon Composite
50-1012-28C	Dual Hole Full Ring, 285mm inner diameter, Carbon Composite
50-1012-30C	Dual Hole Full Ring, 300mm inner diameter, Carbon Composite
50-1017-10C	Dual Hole 2/3 Ring, 105mm inner diameter, Carbon Composite
50-1017-12C	Dual Hole 2/3 Ring, 120mm inner diameter, Carbon Composite
50-1017-13C	Dual Hole 2/3 Ring, 135mm inner diameter, Carbon Composite
50-1017-15C	Dual Hole 2/3 Ring, 150mm inner diameter, Carbon Composite
50-1017-16C	Dual Hole 2/3 Ring, 165mm inner diameter, Carbon Composite
50-1017-18C	Dual Hole 2/3 Ring, 180mm inner diameter, Carbon Composite
50-1017-19C	Dual Hole 2/3 Ring, 195mm inner diameter, Carbon Composite
50-1017-21C	Dual Hole 2/3 Ring, 210mm inner diameter, Carbon Composite
50-1017-22C	Dual Hole 2/3 Ring, 225mm inner diameter, Carbon Composite
50-1017-24C	Dual Hole 2/3 Ring, 240mm inner diameter, Carbon Composite
50-1017-25C	Dual Hole 2/3 Ring, 255mm inner diameter, Carbon Composite
50-1017-27C	Dual Hole 2/3 Ring, 270mm inner diameter, Carbon Composite
50-1017-28C	Dual Hole 2/3 Ring, 285mm inner diameter, Carbon Composite
50-1017-30C	Dual Hole 2/3 Ring, 300mm inner diameter, Carbon Composite



Smart Correction Foot Rings, Aluminium

50-1015-01	Foot Ring, Small, Aluminium
50-1015-02	Foot Ring, Medium, Aluminium
50-1015-03	Foot Ring, Large, Aluminium



Smart Correction Struts

50-1031-00	Dual Joint Strut, Extra Extra Short (XXS)
50-1031-01	Dual Joint Strut, Extra Short (XS)
50-1031-02	Dual Joint Strut, Short (S)
50-1031-03	Dual Joint Strut, Medium (M)
50-1031-04	Dual Joint Strut, Long (L)
50-1031-05	Dual Joint Strut, Extra Long (XL)
50-1032-00	Dual Joint Express Strut, Extra Extra Short (XXS)
50-1032-01	Dual Joint Express Strut, Extra Short (XS)
50-1032-02	Dual Joint Express Strut, Short (S)
50-1032-03	Dual Joint Express Strut, Medium (M)
50-1032-04	Dual Joint Express Strut, Long (L)
50-1032-05	Dual Joint Express Strut, Extra Long (XL)



Ring Components

50-1041-30	Advanced Wire Clamp
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50-1041-00	Wire Clamp
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50-1042-30	Advanced Screw Clamp
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50-1042-00	Screw Clamp
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50-1051-00	Washer
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50-1052-01	Standard Nut
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50-1052-02	NyLock Nut
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50-1053-10	Connection Bolt, XShort
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50-1053-12	Connection Bolt, Short	
50-1053-16	Connection Bolt, Medium	
50-1053-20	Connection Bolt, Long	
50-1053-30	Connection Bolt, X-Long	
50-1058-06	Set Screw, 6mm	
50-1058-04	Set Screw, 4mm	
50-1056-01	Cube, 1 hole	
50-1056-02	Cube, 2 hole	
50-1056-03	Cube, 3 hole	
50-1056-04	Cube, 4 hole	
50-1056-05	Cube, 5 hole	
50-1056-60	Screw Sleeve for Cube, 6mm	
50-1057-60	Threaded Rods, 60mm length	
50-1057-80	Threaded Rods, 80mm length	
50-1057-100	Threaded Rods, 100mm length	
50-1057-120	Threaded Rods, 120mm length	
50-1057-150	Threaded Rods, 150mm length	
50-1057-200	Threaded Rods, 200mm length	
50-1057-300	Threaded Rods, 300mm length	
Ring Fixator Instrument Set		
00-5020-00	Wire Plier	
00-0083-02	Wire Tensioner	
00-0034-40	Wire Cutter	
00-2050-10	10mm Hex Bolt Wrench	
00-2050-13	13mm Hex Bolt Wrench	

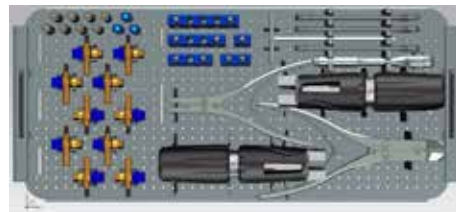
00-2033-15T T Allen Wrench , 3mm/150mm



00-2050-10P 10mm, Torque Wrench



00-8103-00 Ring Fixator Tray



00-0022-00 Hammer (Light)



00-3321-20 Quick Release Drill, 3.2mm Diameter, 200mm Lenght



00-3323-20 Quick Release Drill, 3.2mm Diameter, 200mm Lenght, Cannulated



00-3481-03 Quick release Drill, 4.8mm Diameter, 280mm Lenght



00-3483-28 Quick release Drill, 4.8mm Diameter, 280mm Lenght, Cannulated



00-0041-32 Drill Guide 3.2mm



00-0041-48 Drill Guide 4.8mm



00-0052-40 Soft Tissue Guide, 40mm



00-0052-60 Soft Tissue Guide, 60mm



00-0050-00 Trocar



00-2035-15 Allen wrench, 5mm/190mm



00-2036-00 T-wrench for Bone Screws



00-0130-10 Osteotome, 10mm blade



00-0130-15 Osteotome, 15mm blade



00-7057-00 2.0mm X 250mm Non-Threaded Guide Wire



00-0013-90 Depth Gauge, 4.5/6.0mm Range, 90mm length



00-0036-60 Rod Cutter (modular handle)



00-8101-00 General Instrument Tray



CE₂₁₉₅



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