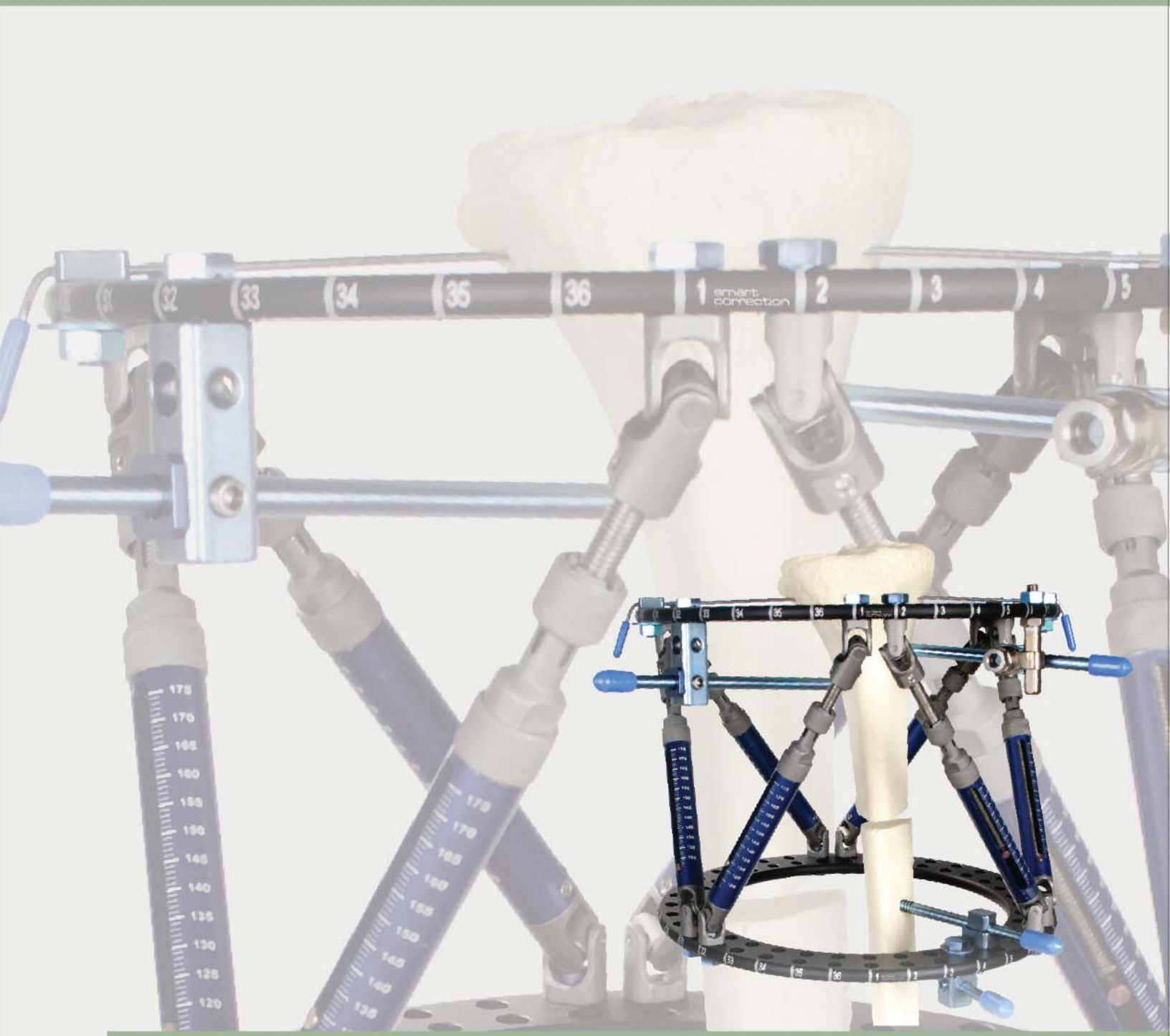
Smart Correction®

Computer Assisted
Hexapod Ring
External Fixator System

smart correction®

Computer-Assisted Hexapod Ring External Fixator System


smart correction

smart correction®

Computer-Assisted Hexapod Ring External Fixator System

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

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.

smart correction®

Computer-Assisted Circular External Fixator System

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 and the Express Strut option provides the acute correction and fixes the adjusted position by the safe threaded locking mechanism.

Dual Hole Ring

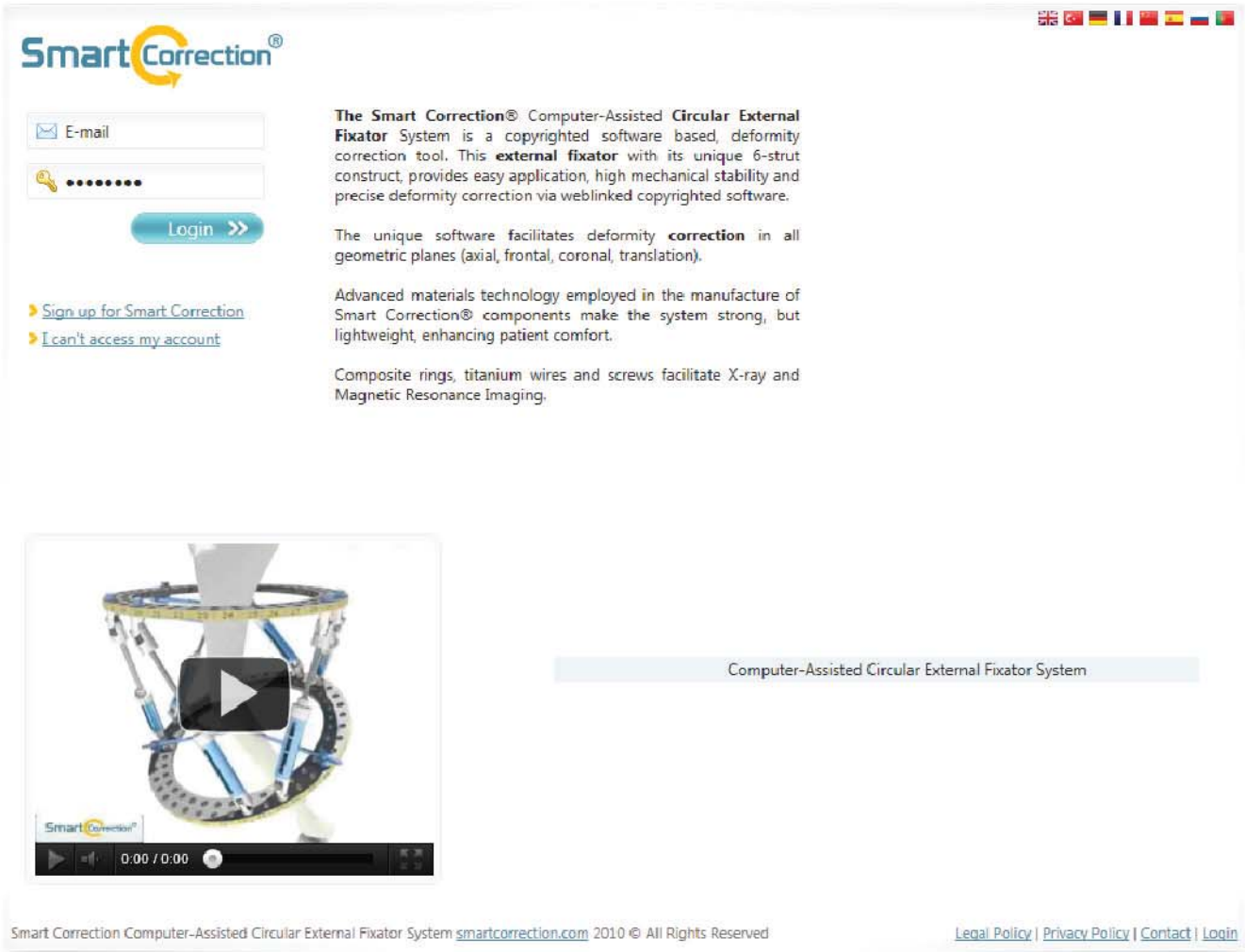
Aluminium and Carbon Fiber rings with double parallel sets of holes offer optimal positioning of wire and pin clamps in a lightweight ring. 2/3 and foot rings also available.

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.

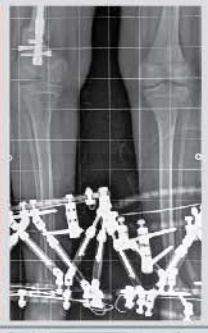
Accurate User Friendly Software "click to correct™"

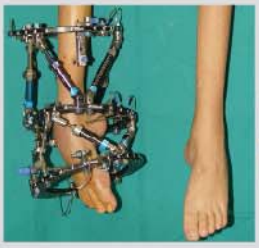
Provides an accurate deformity correction schedule for the patient and surgeon, which is kept on file and can be reviewed and modified at any point in the correction procedure.



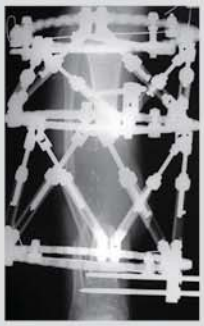
Case Examples

Case Examples



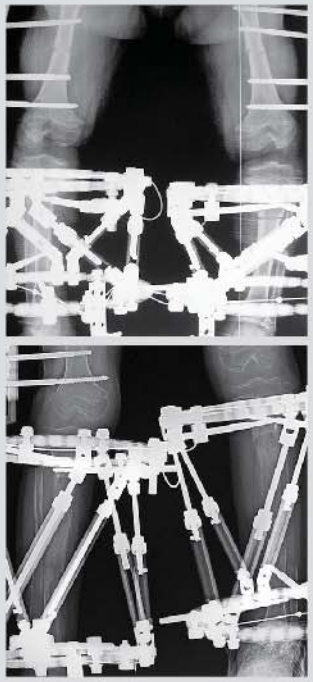


Case Examples



Case Examples

Case Examples



Introduction

The Smart Correction® System is designed for the treatment of fractures, nonunions, malunions and pseudoarthrisis through computer working conjuction radiographic navigation system. The computer asisted planning and correction provides 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 web-based software with Radiographic Navigation which provides a schedule detailing the necessary strut adjustments needed to achieve the chosen deformity correction.

Positioning of the Proximal Ring

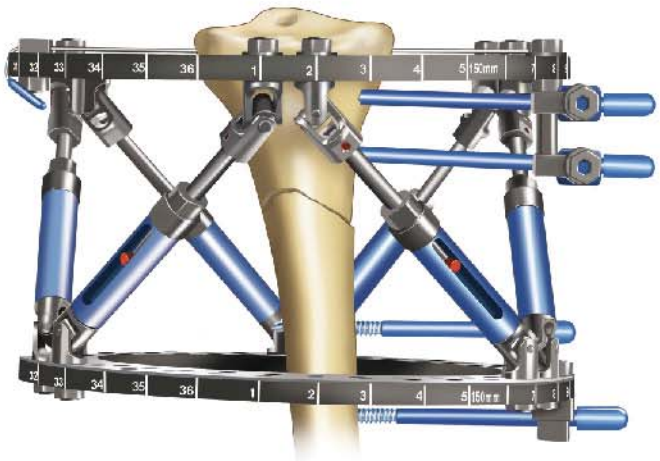
The appropriate sized ring should be chosen to avoid ring contact with the skin both initially and during the correctional procedure. There are nine ring diameters available (105mm, 120 mm, 135mm, 150mm, 165mm, 180mm, 195mm, 210mm and 225mm). The rings have two concentric hole series. When constructing 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 Strut Position (Strut 1 & Strut2)

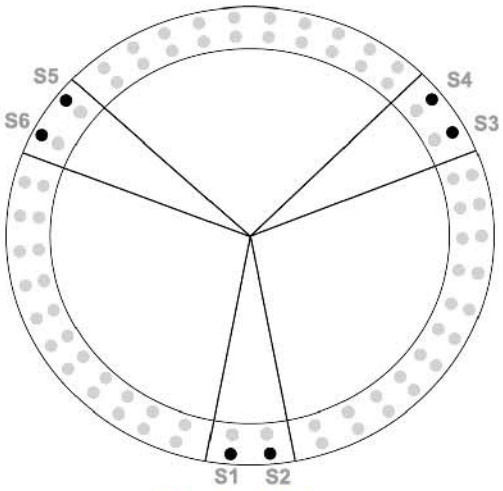
Fix the first strut (Strut 1) into the hole no. 1 and second strut (Strut 2) into the hole no.2 in the Proximal ring. This is the recommended ideal position although the system allows for the changes of strut positions on the rings as per the table below. Between 2 and 3 empty holes may be left between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



Proximal Ring

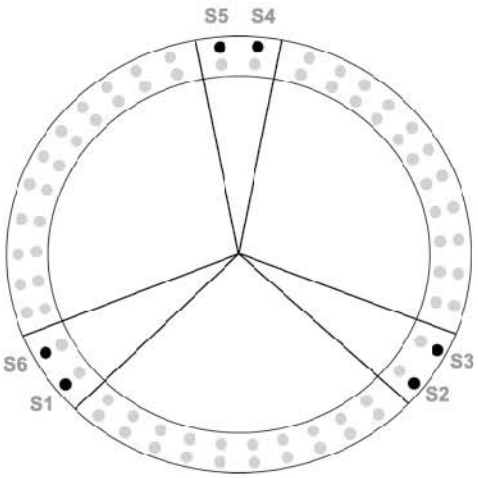
Positioning of the Distal Ring

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

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



Distal Ring

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

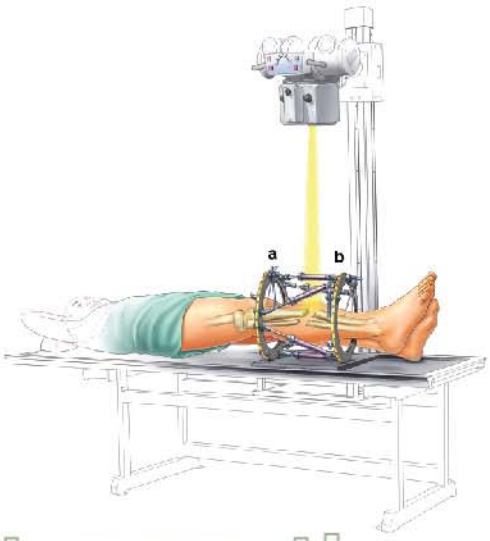
Post-operatively the orientation of the frame, the position of the struts and the ring sizes need to be recorded on the Patient Data Form (can be dowloaded from the web site).

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.

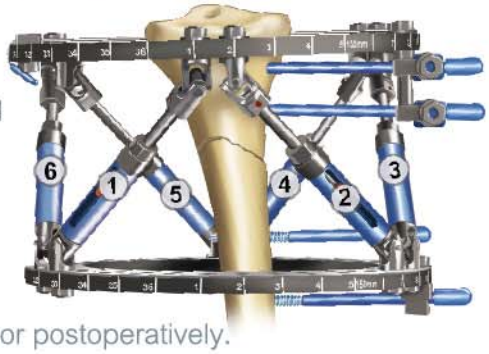
(a) Nearest point to the x-ray source on the Proximal ring.
(b) Nearest point to the x-ray source on the Distal ring.

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 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.



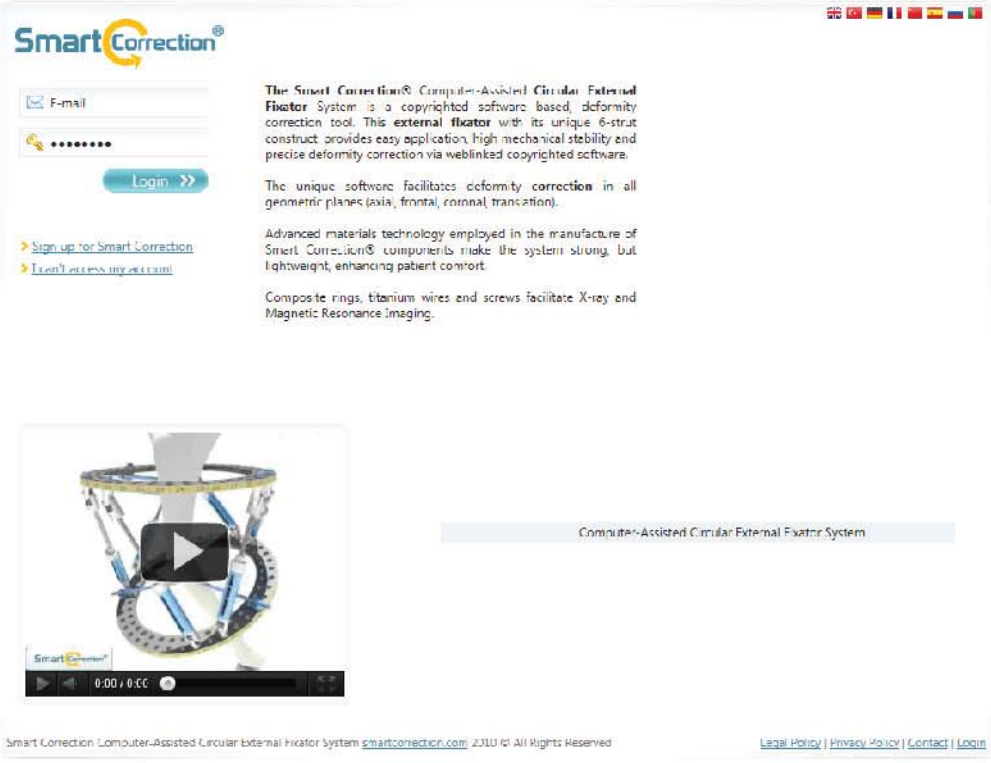
The sizes and position of the rings and struts used are recorded on the Smart Correction® Patient Data Form either during the procedure or postoperatively.

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 "click to correct™" 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.

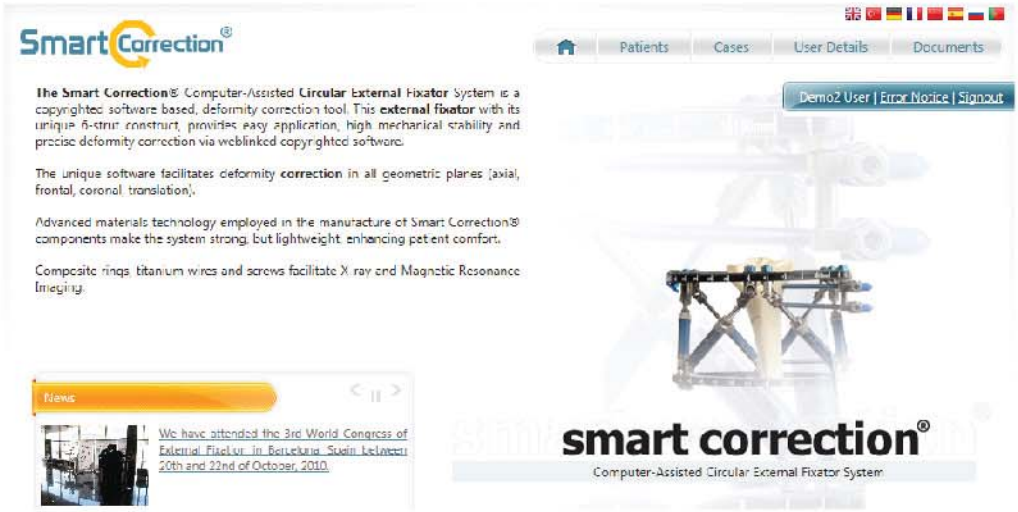
Software Access

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, 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.



Software Instructions – New Patient Record

To create a new Patient Record select the "New" button.

Complete the Patient Details as appropriate

Software Instructions – Patient Records

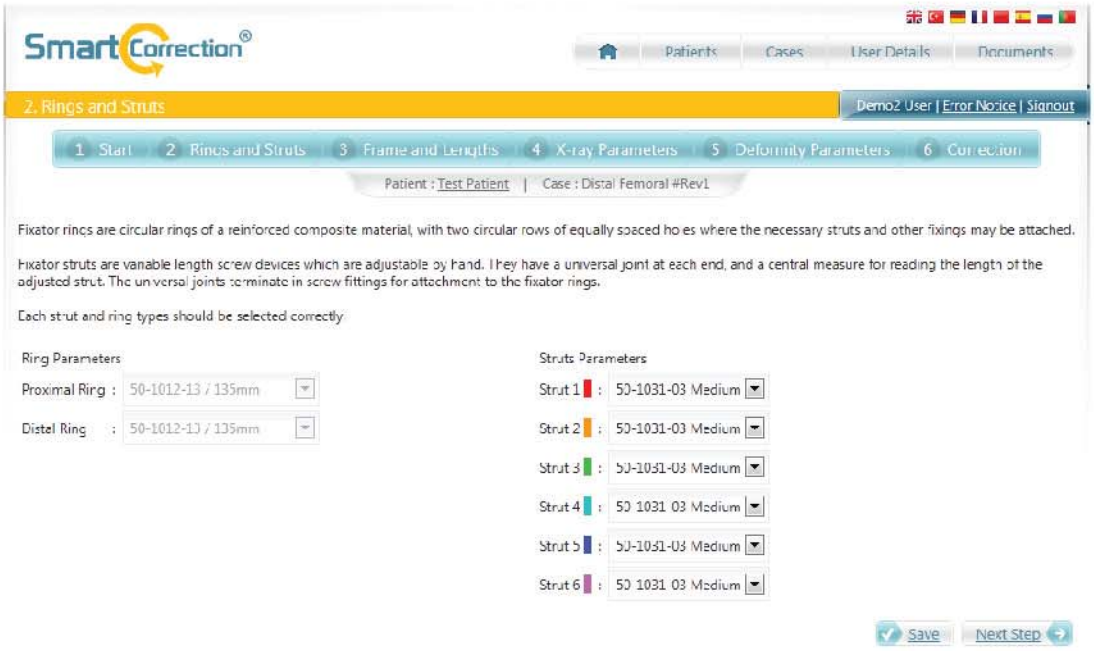
Each patient can have several different cases held under their Patient Record, including revisions.

Data Entry – Enter Ring Size, Strut Size and Position

The information recorded on the Patient Data Form needs to be entered into the software in order for the software to create the patient treatment protocol.

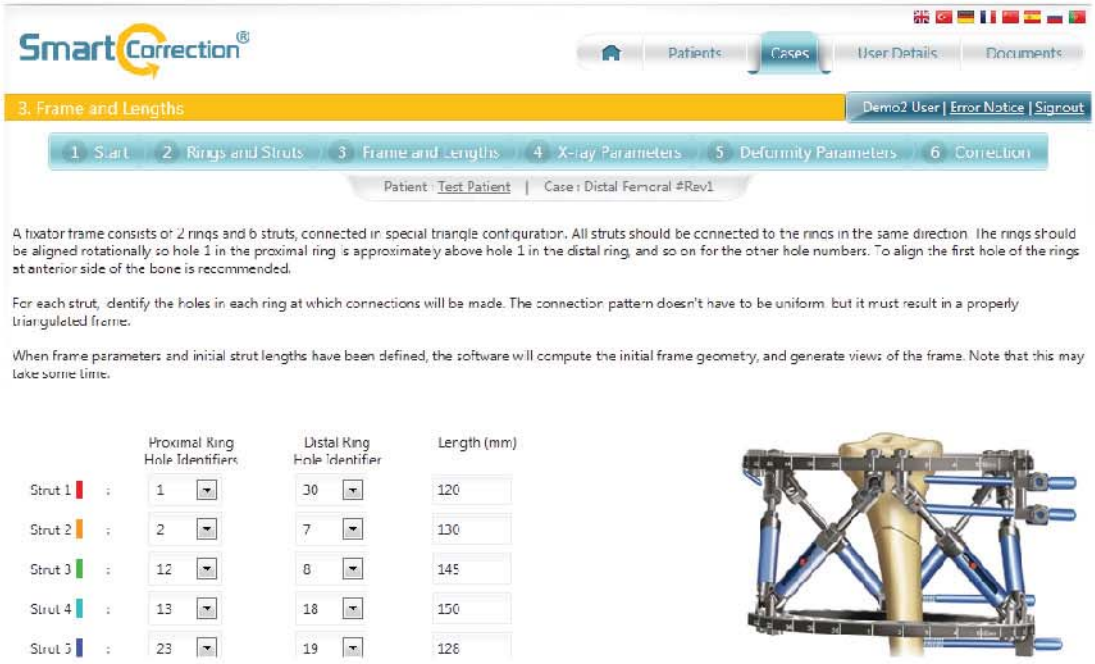
Ring and Strut Selection

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



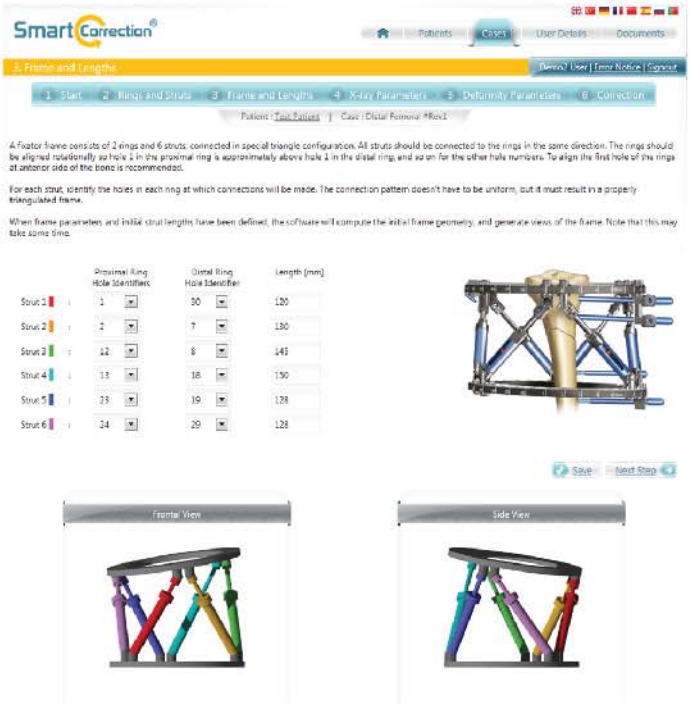
Strut Position and Length Data Entry

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.



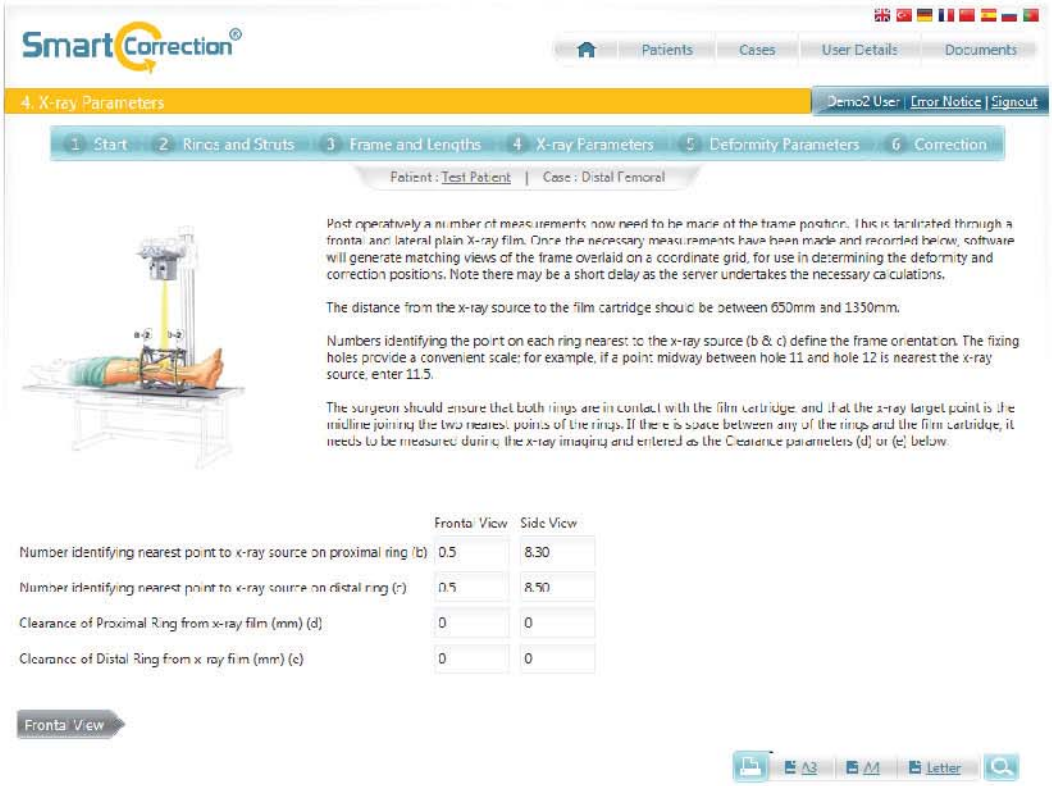
Model Creation

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.



Data Entry - X-ray parameters

Select the X-Ray parameters tab. Enter the data from Patient Data Form for parameter a and b, for the Frontal and Lateral X-rays. The recommended distance between x-ray source and x-ray cartridge is between 650mm and 1350mm.

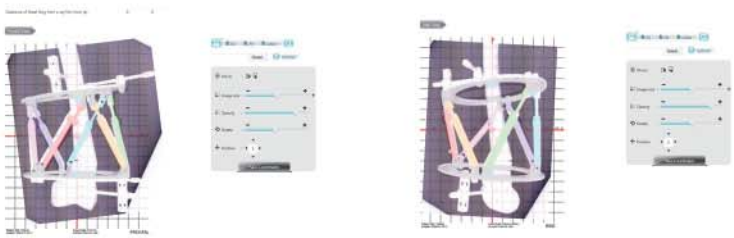


Bone Segment Mapping

It is important to describe the position of the bone fragment relative to the frame. This is achieved by overlaying the grid maps generated by the "click to correct™" Radiographic Navigation Softwarewith the radiographic images.

The patient radiographs will need to be uploaded to the software. Select the appropriate image file by clicking on "Browse" and choosing the JPEG file corresponding to the A/P view.

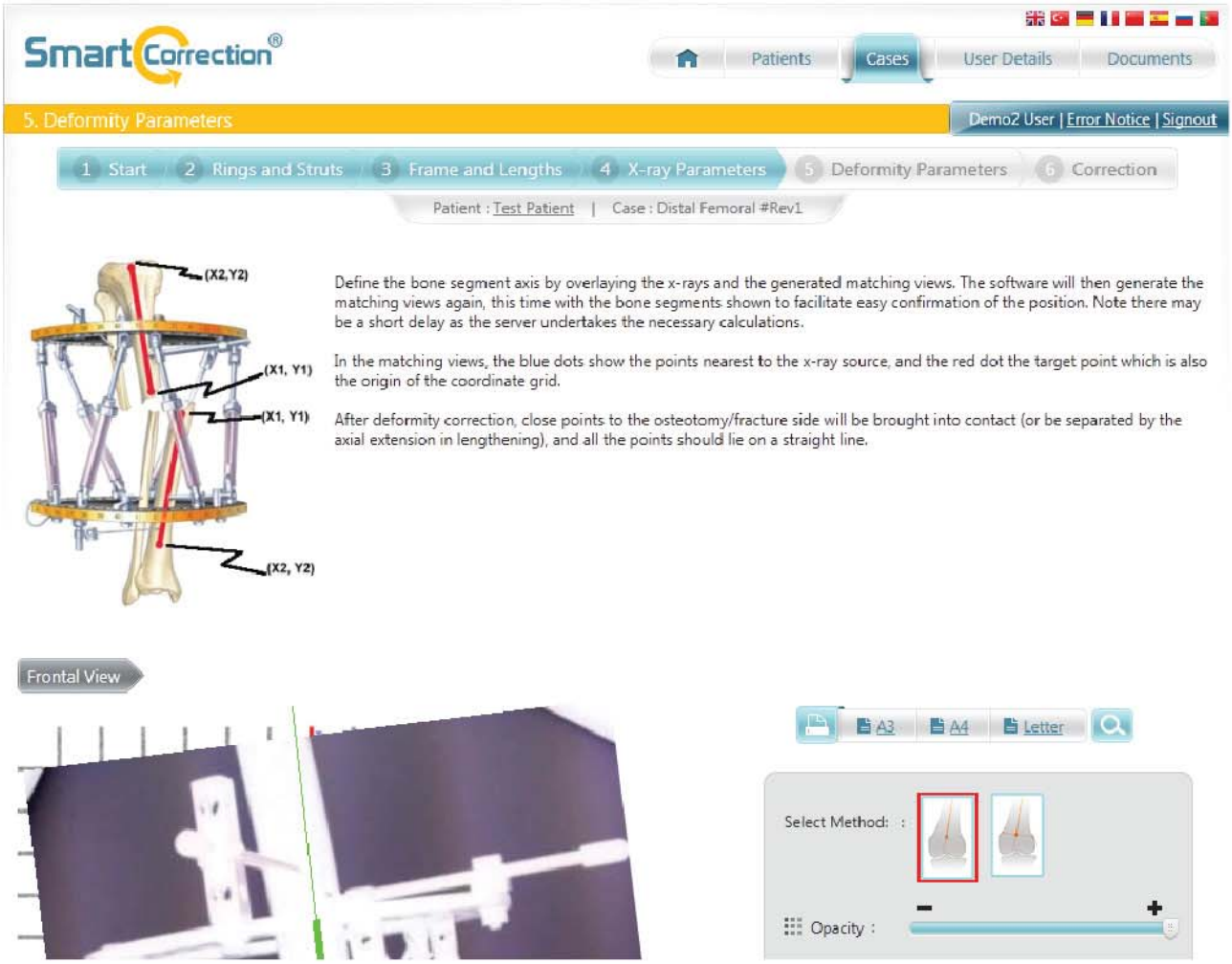
Note: the screen may darken slighly as the data is transmitted.



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.

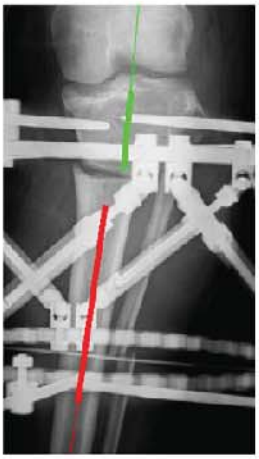
Deformity Parameters

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

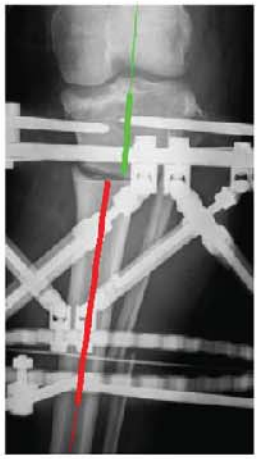


Select the "Proximal Segment - Top Point" from the list, using the pointer, selecting the point on the radiograph corresponding to this description. The bone axis should be marked via mid-diaphyseal points. There are two options available to find the mid-diaphyseal point on the x-ray images. The first option is to click on the mid-diaphyseal point directly. The second option is to click on both cortexes 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 concomittant discomfort and pain. The amount of compression/distraction can be determined and controlled by the positioning of these segments.

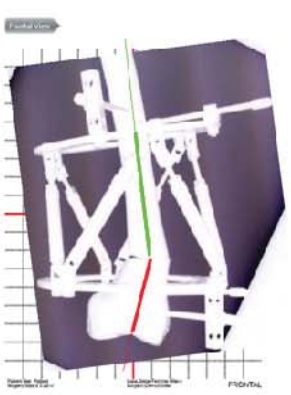


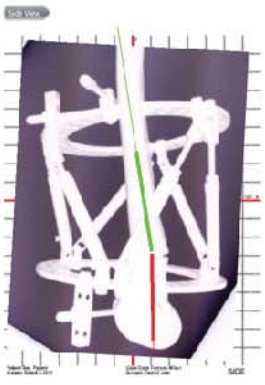
Incorrect



Correct

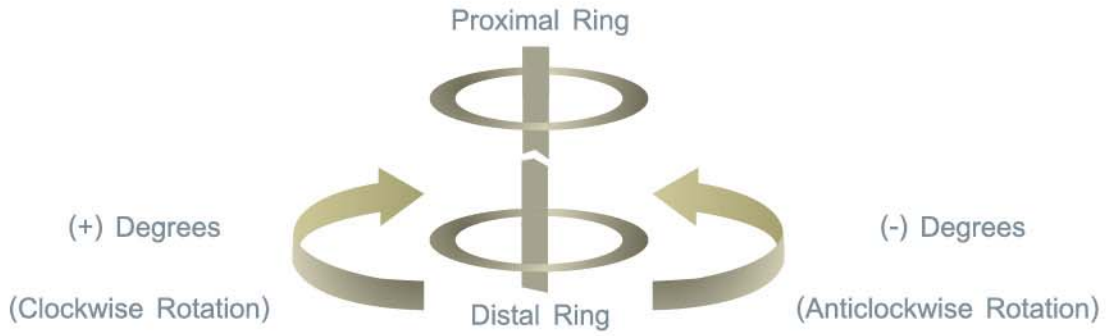
Repeat this step for the remaining three segment points for the Frontal view.
Note: X and Y parameters may also be entered manually as numerical figures. This process is then repeated for the Lateral view.





Distraction and Rotation

At this point the amount of desired lengthening or compression (mm) and rotation (degrees) will need to be entered. Rotation of the frame takes place in the distal ring and is relative to the position of the proximal ring. Rotation of the distal ring clockwise (as viewed from above as if from the patients eyes) is entered as positive (+) degrees and rotation anticlockwise is entered as a negative (-) number.



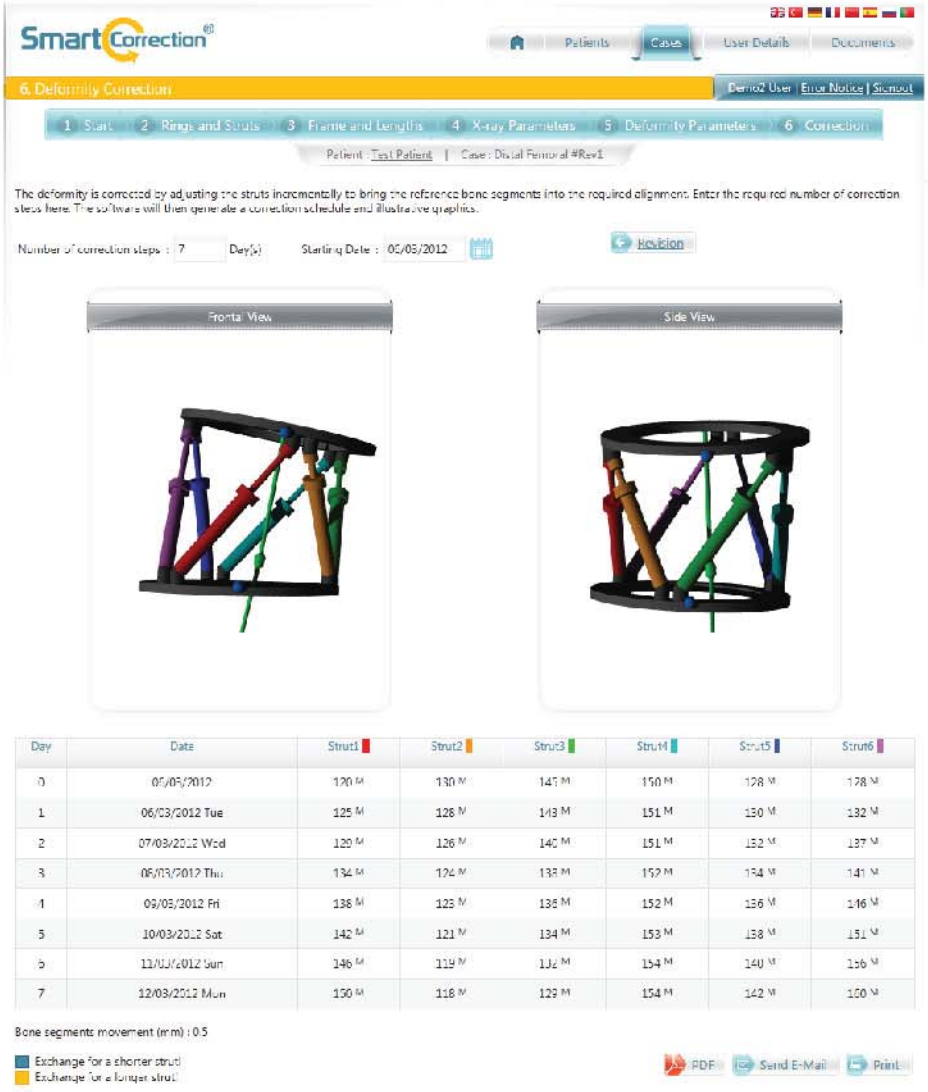
After the bone segments mapping and Distraction/Rotation parameters, the surgeon should now save the data by clicking the "Save" button. **Note: This may take a short while the information is uploaded to the Smart Correction site.**

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.

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.



The information is saved by selecting “Save Case”.

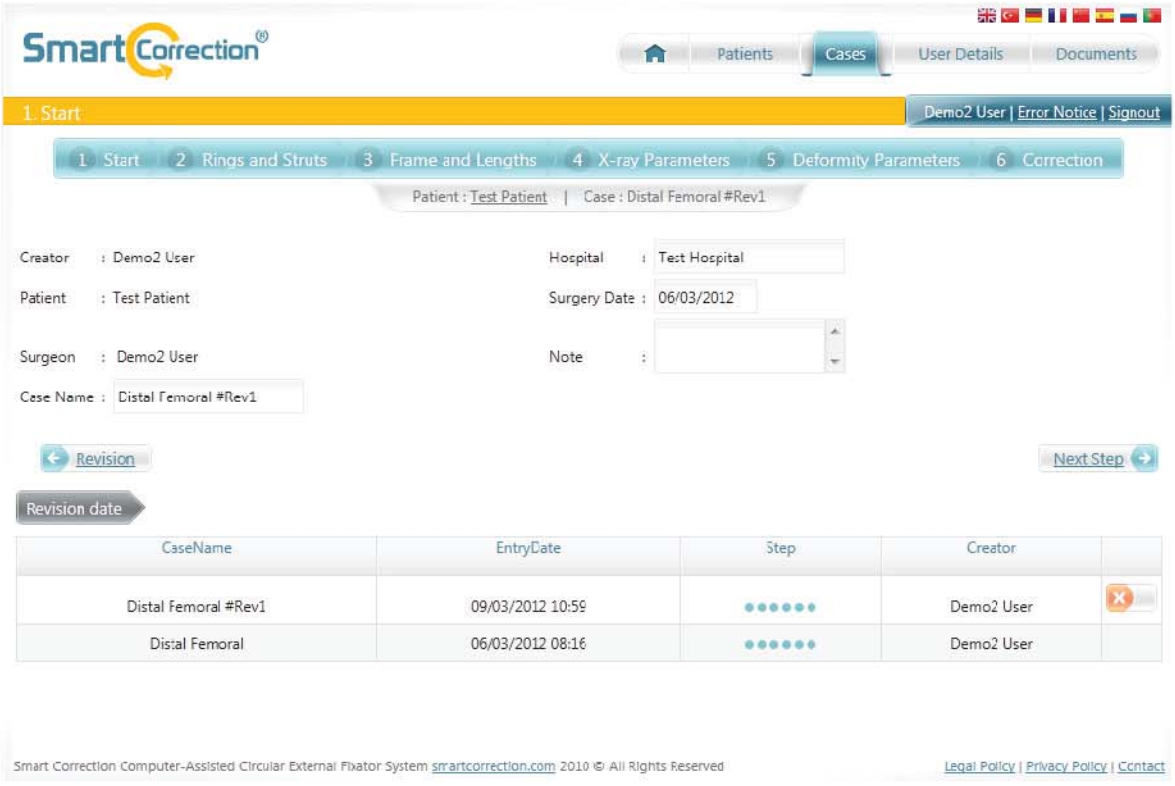
Strut Replacement

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 "Correction" 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 chosed revision day.



Smart Correction System Ordering Information

Code Number	Description	
Smart Correction Fixator Set		
1. 50-1012-10A	Dual Hole Full Ring, 100mm inner diameter, Aluminium	2
2. 50-1012-12A	Dual Hole Full Ring, 120mm inner diameter, Aluminium	2
3. 50-1012-13A	Dual Hole Full Ring, 135mm inner diameter, Aluminium	2
4. 50-1012-15A	Dual Hole Full Ring, 150mm inner diameter, Aluminium	4
5. 50-1012-16A	Dual Hole Full Ring, 165mm inner diameter, Aluminium	4
6. 50-1012-18A	Dual Hole Full Ring, 180mm inner diameter, Aluminium	4
7. 50-1012-19A	Dual Hole Full Ring, 195mm inner diameter, Aluminium	2
8. 50-1012-21A	Dual Hole Full Ring, 210mm inner diameter, Aluminium	2
9. 50-1012-22A	Dual Hole Full Ring, 225mm inner diameter, Aluminium	2
10. 50-1017-12A	Dual Hole 2/3 Ring, 120mm inner diameter, Aluminium	2
11. 50-1017-13A	Dual Hole 2/3 Ring, 135mm inner diameter, Aluminium	2
12. 50-1017-15A	Dual Hole 2/3 Ring, 150mm inner diameter, Aluminium	4
13. 50-1017-16A	Dual Hole 2/3 Ring, 165mm inner diameter, Aluminium	4
14. 50-1017-18A	Dual Hole 2/3 Ring, 180mm inner diameter, Aluminium	4
15. 50-1017-19A	Dual Hole 2/3 Ring, 195mm inner diameter, Aluminium	2
16. 50-1017-21A	Dual Hole 2/3 Ring, 210mm inner diameter, Aluminium	2
17. 50-1017-22A	Dual Hole 2/3 Ring, 225mm inner diameter, Aluminium	2
18. 50-1012-12C	Dual Hole Full Ring, 120mm inner diameter, Carbon Composite	2
19. 50-1012-13C	Dual Hole Full Ring, 135mm inner diameter, Carbon Composite	2
20. 50-1012-15C	Dual Hole Full Ring, 150mm inner diameter, Carbon Composite	4
21. 50-1012-16C	Dual Hole Full Ring, 165mm inner diameter, Carbon Composite	4
22. 50-1012-18C	Dual Hole Full Ring, 180mm inner diameter, Carbon Composite	4
23. 50-1012-19C	Dual Hole Full Ring, 195mm inner diameter, Carbon Composite	2
24. 50-1012-21C	Dual Hole Full Ring, 210mm inner diameter, Carbon Composite	2
25. 50-1012-22C	Dual Hole Full Ring, 225mm inner diameter, Carbon Composite	2
26. 50-1031-00	Dual Joint Strut, Extra Extra Short (XXS)	2
27. 50-1031-01	Dual Joint Strut, Extra Short (XS)	2
28. 50-1031-02	Dual Joint Strut, Short (S)	6
29. 50-1031-03	Dual Joint Strut, Medium (M)	12
30. 50-1031-04	Dual Joint Strut, Long (L)	6
31. 50-1031-05	Dual Joint Strut, Extra Long (XL)	2
32. 50-1032-02	Dual Joint Express Strut, Short (S)	6
33. 50-1032-03	Dual Joint Express Strut, Medium (M)	12
34. 50-1032-04	Dual Joint Express Strut, Long (L)	6
35. 50-1051-00	Washer	40
36. 50-1052-01	Standard Nut	30
37. 50-1052-02	NyLock Nut	30
38. 50-1056-01	Cube, 1 hole	3
39. 50-1056-02	Cube, 2 hole	3
40. 50-1056-03	Cube, 3 hole	3
41. 50-1056-04	Cube, 4 hole	3
42. 50-1056-05	Cube, 5 hole	3

Smart Correction System® Ordering Information (Continued)

Code Number	Description	
43. 50-1056-60	Screw Sleeve for Cube, 6mm	10
44. 50-1058-06	Set Screw, 6mm	20
45. 50-1042-00	Screw Clamp	10
46. 50-1041-00	Pin Clamp	16
47. 50-1041-30	Advanced Pin Clamp	10
48. 50-1042-30	Advanced Screw Clamp	10
49. 50-1053-12	Connection Bolt, Short	30
50. 50-1053-16	Connection Bolt, Medium	30
51. 50-1053-20	Connection Bolt, Long	20
52. 50-1061-20	Wire - 2.0mm, Ti	15
53. 50-1062-20	Wire with Stopper- 2.0mm, Ti	15
54. 50-1057-60	Threaded Rods, 60mm length	4
55. 50-1057-80	Threaded Rods, 80mm length	4
56. 50-1057-100	Threaded Rods, 100mm length	4
57. 50-1057-120	Threaded Rods, 120mm length	4
58. 50-1057-150	Threaded Rods, 150mm length	4
59. 50-1057-200	Threaded Rods, 200mm length	4
60. 50-1057-300	Threaded Rods, 300mm length	4
61. 00-8040-00	Smart Correction Basic Case	1

Smart Correction® System Ordering Information (Continued)

Code Number	Description	
Smart Correction Instrument Set		
1. 00-0022-00	Hammer (Light)	1
2. 00-3321-20	Quick Release Drill, 3.2mm Diameter, 200mm Length	2
3. 00-3323-20	Quick Release Drill, 3.2mm Diameter, 200mm Length, Cannulated	1
4. 00-3481-03	Quick Release Drill, 4.8mm Diameter, 280mm Length	2
5. 00-3483-28	Quick Release Drill, 4.8mm Diameter, 280mm Length, Cannulated	1
6. 00-0041-32	Drill Guide 3.2mm	2
7. 00-0041-48	Drill Guide 4.8mm	2
8. 00-0052-40	Soft Tissue Guide, 40mm	2
9. 00-0052-60	Soft Tissue Guide, 60mm	2
10. 00-0050-00	Trocar	1
11. 00-2033-15T	T Allen Wrench, 3mm/150mm	1
12. 00-2035-15	Allen Wrench, 5mm/190mm	2
13. 00-2036-00	T-Wrench for Bone Screws	2
14. 00-5020-00	Wire Plier	1
15. 00-0034-40	Wire Cutter	1
16. 00-0082-02	Wire Tensioner	2
17. 00-2050-10	10mm Hex Bolt Wrench (ratchet)	2
18. 00-2050-13	13mm Hex Bolt Wrench	2
19. 00-0130-10	Osteotome, 10mm blade (optional)	1
20. 00-0130-15	Osteotome, 15mm blade (optional)	1
21. 00-7057-00	2.0mm X 250mm Non-Threaded Guide Wire	4
22. 00-0013-90	Depth Gauge, 4.5/6.0mm Range, 90mm length	1
23. 50-1070-02	Bone Screw Covers, 6mm/15mm length (6 per pack)	12
24. 50-1070-06	Wire Cover, 1.8/2.0mm/15mm length (6 per pack)	12
25. 00-0036-60	Rod Cutter (modular handle) (optional)	1
26.00-8200-00	Ring Fixator Instrument Tray	1

CE
1015

Manufacturer
Response Ortho LLC
725 River Road
#32-254
Edgewater
NJ, 07020, USA

Smart Correction®

www.smartcorrection.com

smartcorrection