



Hansson Pinloc[®] 2

Swemac



FEMORAL NECK
FRACTURE SYSTEM

Hansson Pinloc® 2

Hansson Pinloc 2 is the second generation Hansson Pinloc implant; an innovative device for the treatment of femoral neck fractures.

The implant features three hook pins locked together by a plate and is an evolution of the long and successful experience with the Hansson Pin system. The Hansson Pinloc concept was developed to address the issue of fracture displacement after fixation and to reduce the risk of disruption to the femoral head blood supply.

By locking three hook pins and a plate into one dynamic unit, the pins are unable to rotate independently from one another as often occurs with isolated screws. In essence, the Hansson Pinloc 2 implant can **recreate the stability of an unbroken hip**. The clinical results are supportive and indicate that Hansson Pinloc 2 can reduce the occurrence of fracture healing complications.

Hook pin fixation

More than **350 000 patients** treated with the Hansson Pinloc, Hansson Pin or Hansson Twin Hook systems.

More than **280 scientific publications** and **10 Ph.D. theses** published on Hansson hook pin fixation technology.

Stability of an unbroken hip

Prevents
angulation

Prevents
rotation

Maintains
compression

Minimal surgical trauma

Preserves the
blood supply

Reduced risk of
secondary fracture

Minimal invasive
surgery

Product overview

The Hansson Pinloc 2 implant is part of the Swemac Femoral Neck Fracture System (FNF) and requires the FNF instrument platform for implantation. All implants are made from titanium alloy (Ti6Al4V) and delivered sterile for immediate use.

The implant consists of three cylindrical hook pins that are inserted through a locking plate into pre-drilled holes in the proximal femur. Fixation in the femoral head is achieved by pushing the inner sliding tongue out through the window of the outer pin.

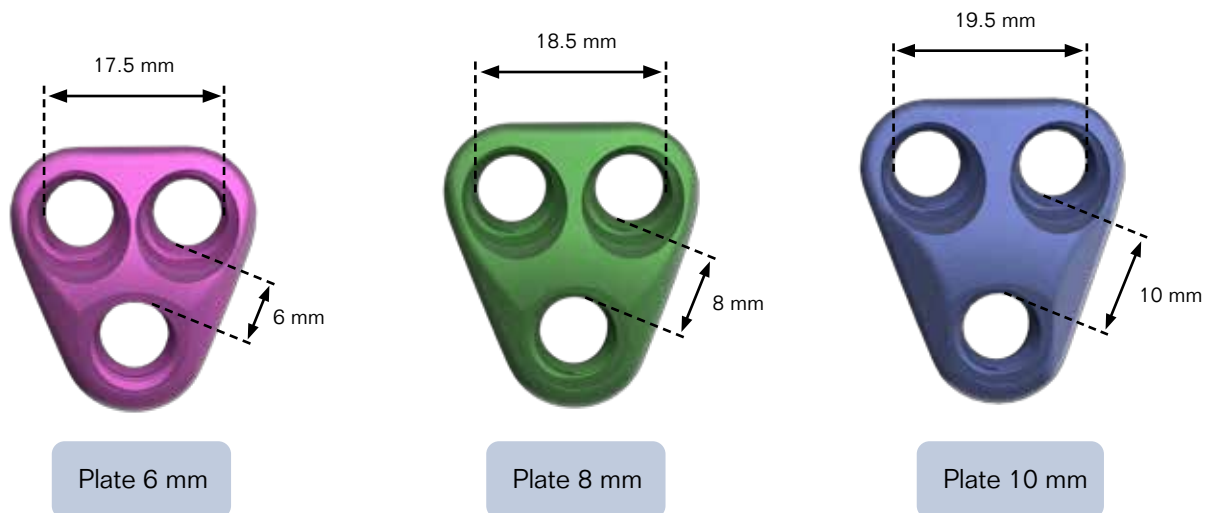


Hook pins

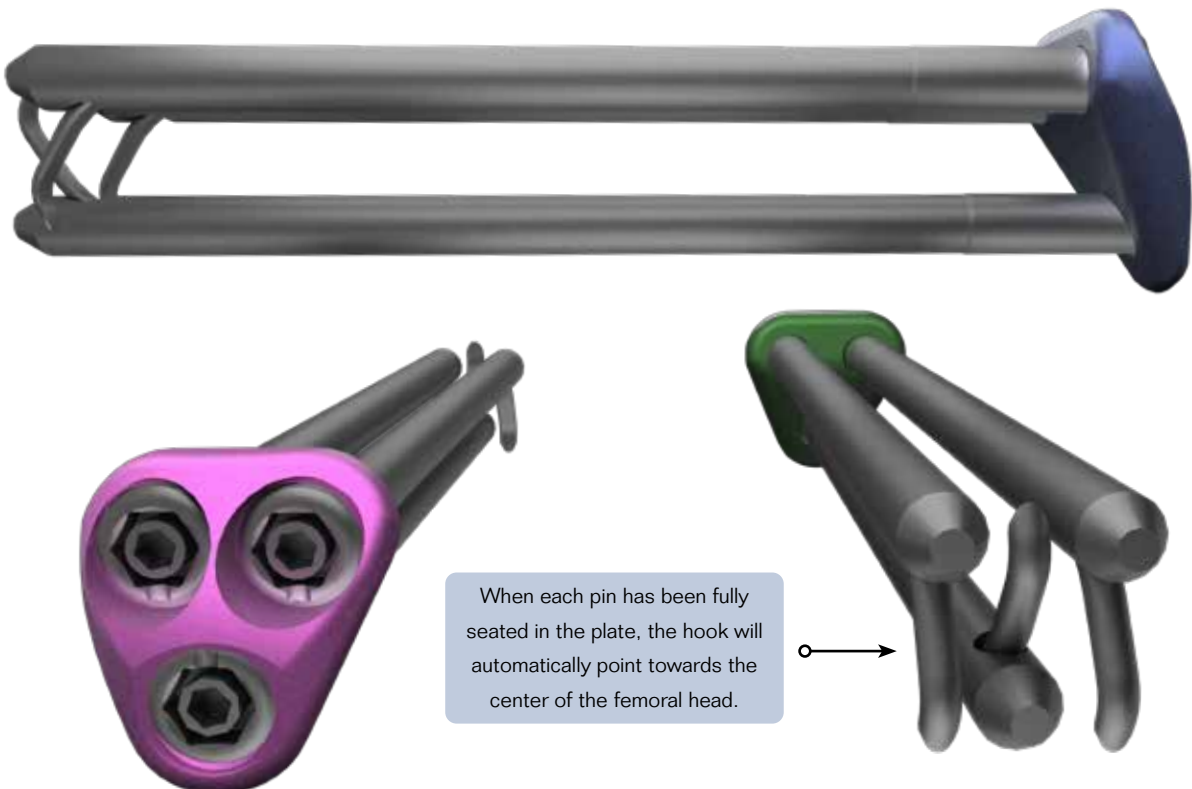
The hook pins consist of three parts, an outer pin, an inner sliding tongue and a combined introduction and extraction screw. The diameter of a single pin is 6.5 mm and they are available in 2.5 mm increments from 70 to 130 mm.

Plates

Plates are available in three different sizes (6 mm, 8 mm and 10 mm), each with a CCD angle of 120° (angle between the pins and the plate). The sizing of the plates refers to the distance between the inferior pin and the proximal pins. The plate is triangular because in most cases it will need to be slightly rotated for the pins to fit the offset of the femoral neck from the femoral shaft.



The fully assembled Hansson Pinloc 2 implant consists of 3 hook pins locked in the chosen plate. When fully assembled, the Hansson Pinloc 2 implant becomes one unit.

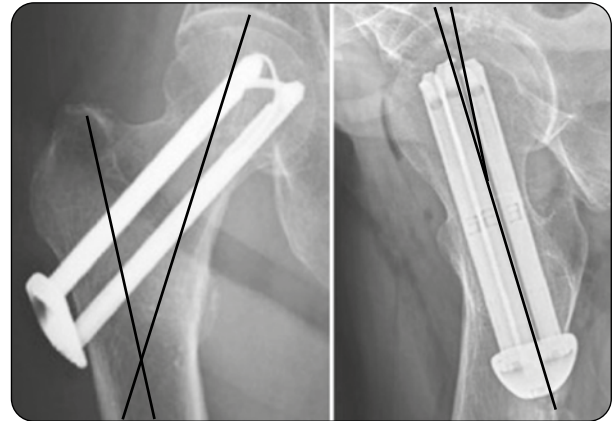


Stability of an unbroken hip

Prevents angulation

Clinical and biomechanical studies have shown that Hansson Pinloc 2 prevents varus and dorsal angulation.

When using Hansson Pinloc 2, the Garden Alignment Index (GAI) in both the AP and ML view only changes minimally from the first post-operative day compared to 3-6 months post-operatively (Ref. 1-8).



AP GAI

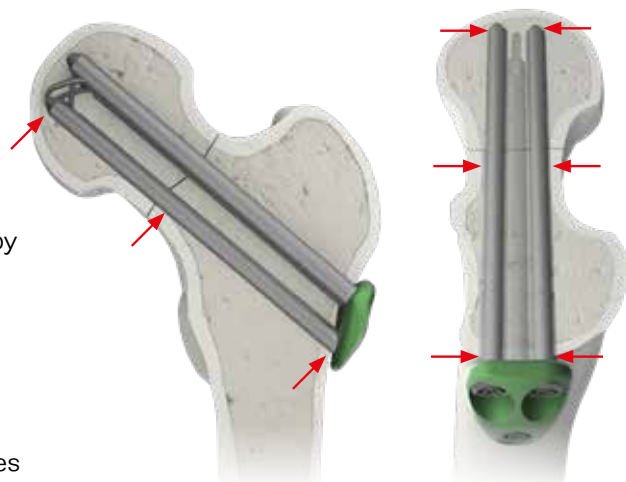
ML GAI

“ Compared to established methods all together, Pinloc improved torsional, bending and compressive stability. In compression the impact was most evident by enhanced dynamic stability without adverse effects in fatigue testing. This indicates the presence of an increased multidirectional stability with retained intermediate dynamic compression. ”

Brattgjerd, JE. Steen, H. & Strømsøe, K. (2020)
(Ref. 1)

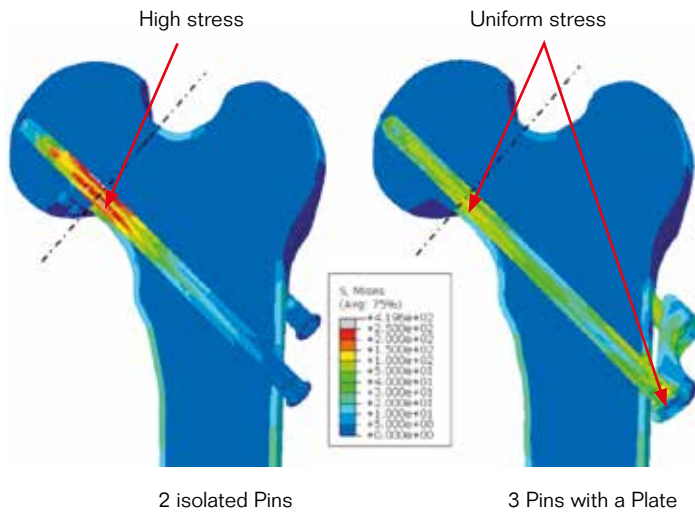
Cortical bone for buttressing

- Each Pin contacts strong cortical bone in three places to provide maximum stability. Hansson Pinloc 2 does not rely on soft cancellous bone for support and the risk of displacement is thereby minimised (Ref. 6-8).
- It is important to have a large contact area at the fracture site in order to stabilise the fracture. The shaft diameter of each Pin is 6.5 mm. Most cannulated screws used for femoral neck fractures have a shaft diameter of only 4.5-4.8 mm (Ref. 9-11).



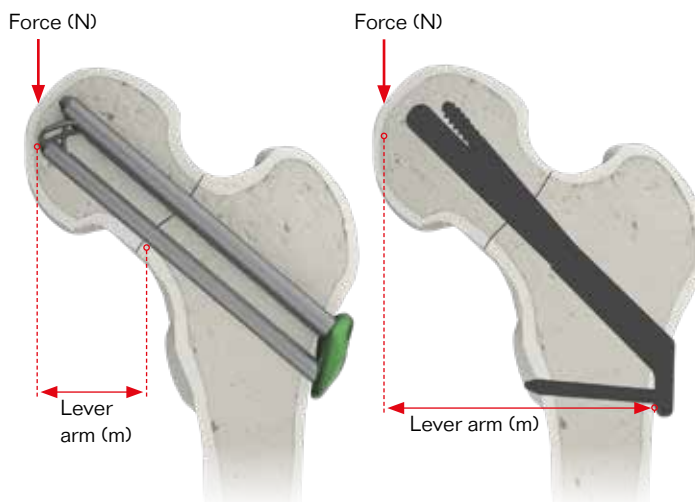
Three point contact with cortical bone provides maximum stability. The inferior Pin contacts the inferior cortex of the femoral neck. The posterior Pin contacts the posterior cortex of the femoral neck. The anterior Pin contacts the anterior cortex (if possible) of the femoral neck.

Finite element analysis



Angle stable pins distributes the load

By locking 3 pins and a plate into one dynamic unit, the plate acts as a load transmitter. This reduces stress and deformation at the fracture site both on the implant and at the implant / bone interface. Stress and deformation in the fracture is reduced by more than 50% compared to isolated pins or screws (Ref. 12-13).



Reduced bending moment

The shorter lever arm of Hansson Pinloc 2 decreases tensile strength on the implant and the implant bone interface. This provides a more efficient load transfer compared to a compression hip screw system or any other type of implant that does not rely on inner medial cortical buttressing (Ref. 1, 14).

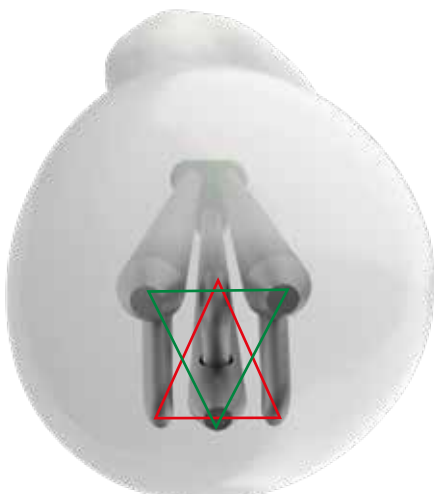
By using the inner medial cortex for buttressing, the Hansson Pinloc 2 can reduce the bending moment.

$$\text{Bending moment (Nm)} = \text{Force (N)} \times \text{Lever arm (m)}$$

Firm anchorage in the femoral head

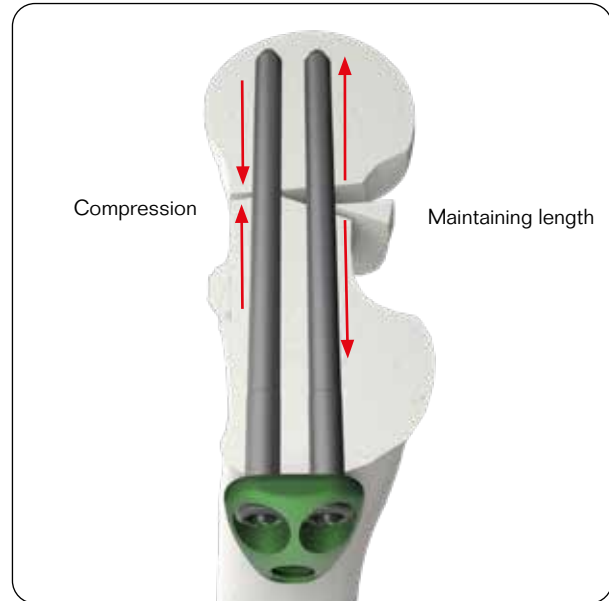
The hook of each Pin engages in subchondral bone to provide secure anchorage and prevent migration or backing out.

By locking three pins and a plate into one unit, the holding power in the femoral head is three times higher compared to an isolated screw or pin (Ref. 15).



One dynamic unit prevents posterior tilt

Post-operatively, Hansson Pinloc 2 allows the distal fragment to slide on the parallel Pins to compress the fracture. By locking three pins and a plate together into one dynamic unit, true angular stability is achieved. The posterior Pin cannot slide independent of the other pins which prevents tilt and shortening on the posterior side (Ref. 3-5, 15).



Hansson Pinloc has the ability to compress the fracture, maintain length and prevent posterior tilt.

“ Osteosynthesis using Hansson Pinloc shows that failure of osteosynthesis is unlikely even in cases with large posterior fragments where it is hard to obtain posterior buttressing. ”

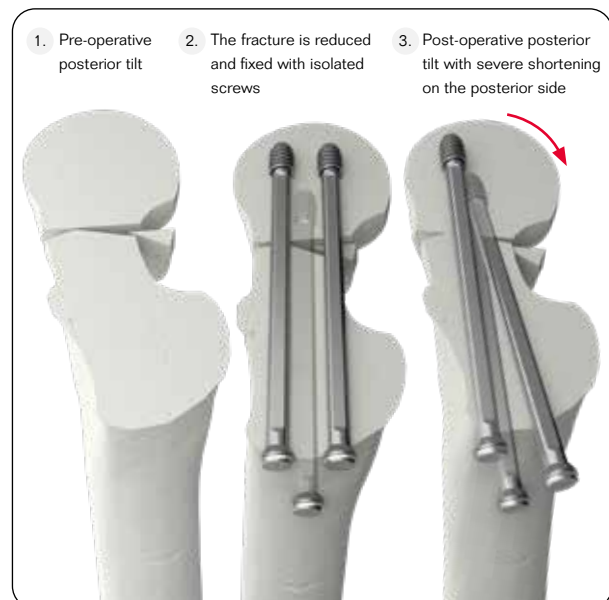
Matsushima, S. Tanaka, S. Nakanishi, Y. Waki, T. & Yano, S. (2019)
(Ref. 4)

Why is this important?

Studies have shown that posterior tilt is a significant predictor of reoperation when using isolated screws or pins.

“ 14/25 (0.6) of patients with posterior tilt of $\geq 20^\circ$ were reoperated, as compared to 12/88 (0.1) of patients with tilt of $< 20^\circ$ ($p < 0.001$). A posterior tilt of $\geq 20^\circ$ was the only significant predictor of reoperation. ”

Palm, H. Gosvig, K. Krashennnikoff, M. Jacobsen, S. & Gebuhr, P. (2009)
(Ref. 17)



Failure mode in fractures with posterior comminution after fixation with isolated screws.

Biomechanical analysis

A dynamic validation of 2 isolated Hansson Pins and 3 Hansson Pins locked in a Plate was performed. Six pieces of the 4th generation femur composite bones (Sawbones Inc.) were used in each of the 2 validation groups. A transcervical fracture with a 10 mm inferior wedge was made to all sawbones.

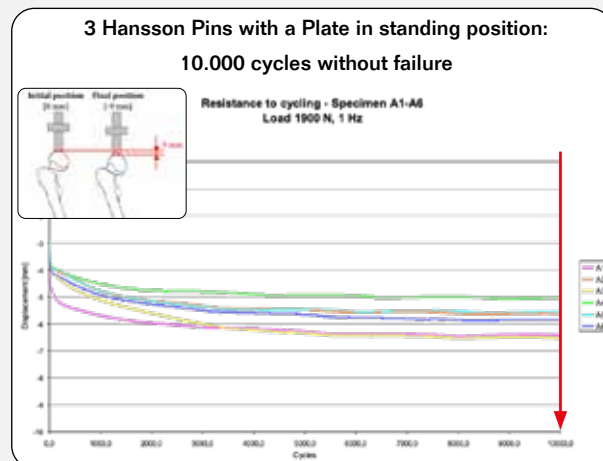
The following set-up of an Instron machine was used:

- Dynamic load: 1900 N (Ref. 12).
- Cycles: 1 Hertz.
- Load corresponding to 159° joint reaction force.

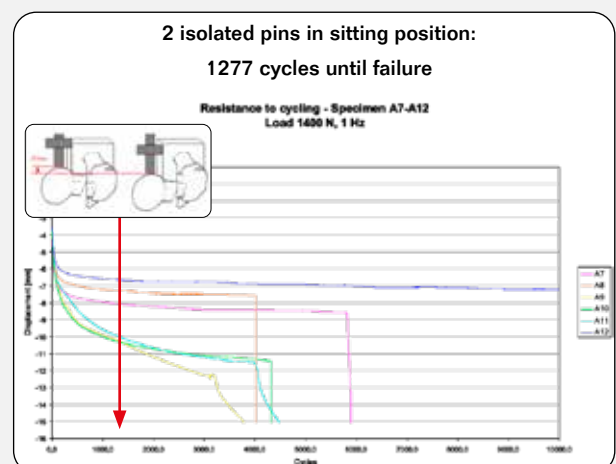
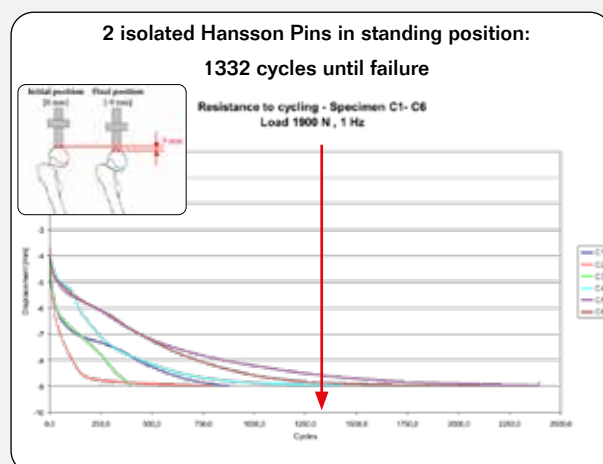
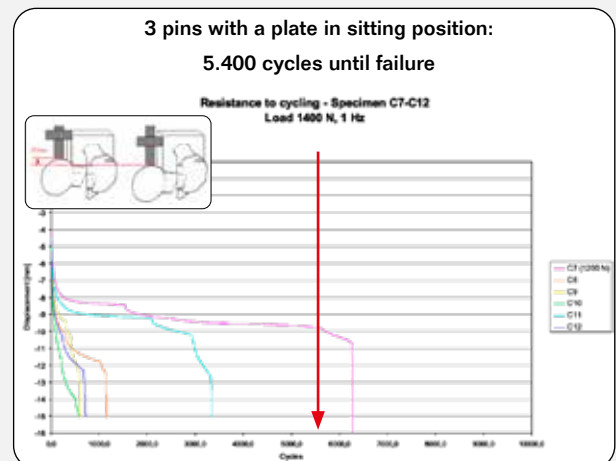
The following stop criteria was used:

- Fracture surfaces compacted
- Displacement > 9 mm
- Max 10.000 cycles

Standing position



Sitting position



Conclusion

The dynamic validation showed that Hansson Pinloc (with 3 Hansson Pins locked in a Plate) is superior to 2 isolated Hansson Pins in both a standing and sitting position (Ref. 18-19).

Prevents rotation

Clinical and biomechanical studies have shown that Hansson Pinloc 2 prevents rotation between the distal and proximal fragments in a femoral neck fracture (Ref. 20-23).

Rotationally stable distal and proximal fixation

- By locking three pins and a plate together, the Pins cannot twist in relation to each other. This means that the femoral head can only rotate if all Pins cut through bone simultaneously.
- The Hansson Pinloc 2 implant forms a triangle inside the triangular shaped femoral neck. A triangle cannot rotate inside a triangle.
- The outer pins are prevented from twisting around their own axes by being anchored and interlocked through 12 mm long hooks in the femoral head.



Why is this important?

If rotation occurs, one cortex can end up outside the other cortex allowing the fracture to sink in to varus or dorsal angulation.

“ The largest movement (translation) of the femoral head during weight-bearing is forward or backward rotation around the transverse-axis of the femoral neck. ”

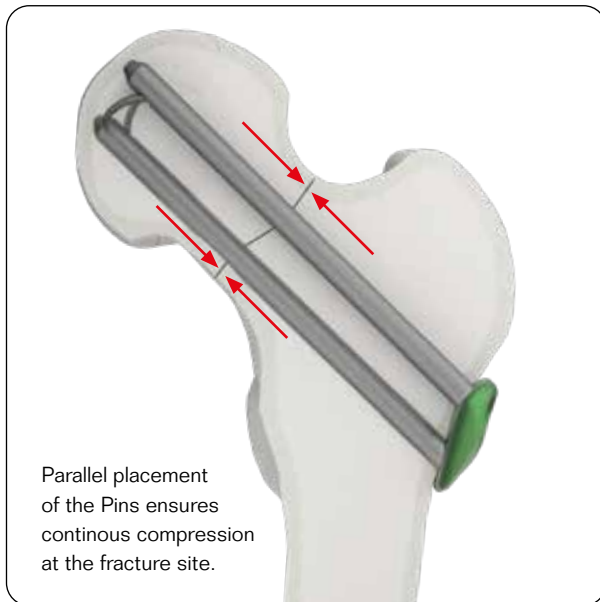
Ragnarsson, JI. Hansson, LI. & Kärrholm, J. (1989)
(Ref. 24)



A CT scan showing the Hansson Pinloc 2 implant inside the triangular shaped femoral neck.

Maintains compression

Clinical and biomechanical studies have shown that Hansson Pinloc 2 allows for fracture dynamisation whilst reducing shortening of the femoral neck compared to isolated pins or screws.



Precise parallel placement

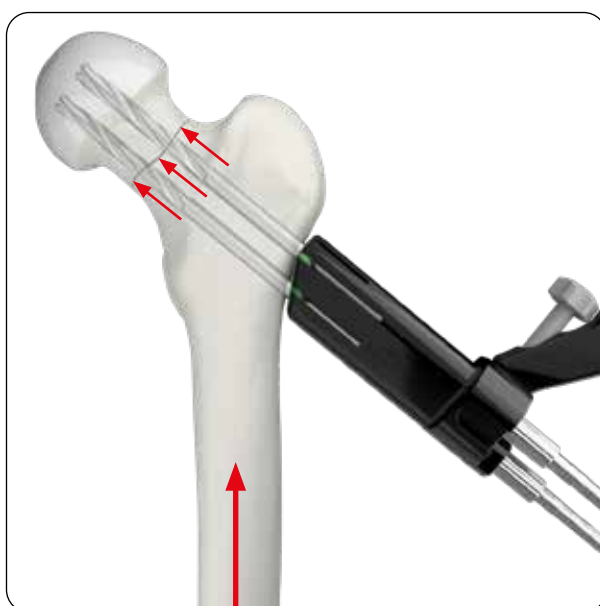
The parallel placement of the Pins does not depend on thin Guide Wires. Ø6.7 mm Drills are introduced through deep parallel drill tubes ensuring fracture dynamisation and continuous contact with bone, even during resorption. This will stimulate bone union and unload the implant which will reduce the risk of implant breakage or cut-out of the femoral head (Ref. 1, 25).

No risk of jamming and/or Z-effect

The Hansson Pinloc 2 implant does not have any plate barrels. This completely removes the risk of jamming and/or Z-effect which has been described with plate barrel type implants (Ref. 26-28).

“ Convergence has been reported to increase the incidence of non-union. Therefore, placement of parallel peripheral pins, is considered ideal. **”**

Bray, T.J. Smith-Hoefer, E. Hooper, A. & Timmerman, L. (1988)
(Ref. 29)



Reduced shortening

Shortening of the femoral neck has been shown to be the single largest factor adversely affecting the SF-36 physical functioning score (Ref. 30).

Several studies have shown that Hansson Pinloc 2 can reduce shortening of the femoral neck by up to 50% compared to isolated pins or screws. This is achieved by increased multidirectional stability and by reducing the intra-operative traction after insertion of the drills (Ref. 1, 3-5, 22, 30-31).

Minimal surgical trauma

Preserves the blood supply

No rotational forces or hammering

The smooth profile of the Pins allows for sliding into final positioning without applying rotational forces or hammering. This minimises disruption to the blood supply and the consequent danger of avascular necrosis (Ref. 32).



A Pin is inserted through a drilled hole and atraumatically advanced into the femoral head. The proximal Pins are placed just above the central axis of the femoral neck. The hook is deployed by turning the introduction screwdriver clock-wise whilst gently pushing medially on the T-handle.

Avoiding the lateral epiphyseal arteries

By avoiding the area where the lateral epiphyseal arteries enter the femoral head, the Hansson Pinloc 2 implant can prevent further damage to the lateral epiphyseal arteries that support 2/3 of the blood circulation to the femoral head (Ref. 33-35).



The proximal Pins are placed just above the centre line of the femoral neck and head.

“ The difference in incidents of necrosis of the femoral head was significantly lower in the hook pin group for displaced fractures (odds ratio 3.5 $p=0.036$). ”

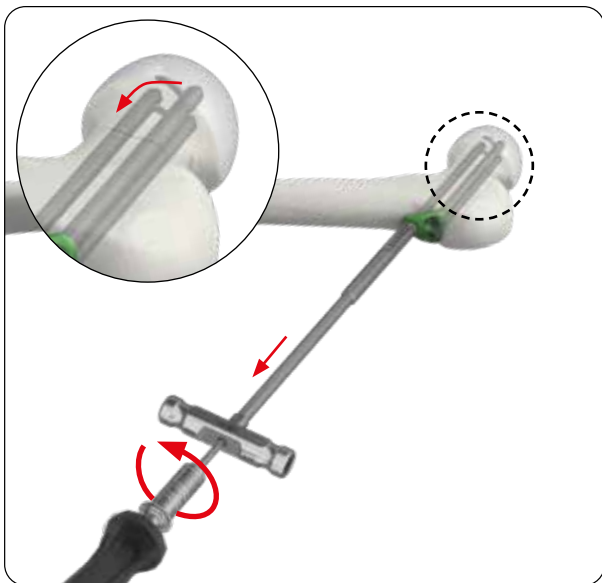
Lykke, N. Lerud, P.J. Strømsøe, K. & Thorngren, KG.
(2003)
(Ref. 35)



Hansson Pinloc 2 is the only angle stable implant that can enter the lateral cortex in the level of the lesser trochanter without the risk of jamming.

Reduced risk of secondary fracture

The CCD angle between the Pins and the second generation Pinloc Plate has been reduced to 120°. This ensures that the inferior Pin enters the lateral cortex opposite the lesser trochanter where the diameter of the bone is wider and stronger. The risk of secondary fracture is thereby reduced as described in the literature (Ref. 35-37).



About 30 000 hook pins have been removed over the years.

Minimal invasive surgery

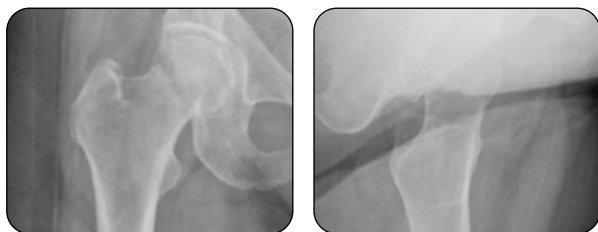
Small incision

The complete procedure is carried out through a 30-40 mm skin incision. Simple instrumentation and a reproducible procedure allows fixation to be achieved within an adequate time frame.

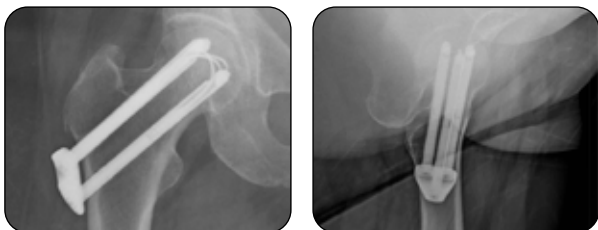
Easy extraction

The procedure for Pin removal is quick and straightforward. The risk of the Pin being trapped in the bone is reduced as the Pin surface is smooth and coated (Type II anodized) to prevent bone ongrowth. The hook is easily withdrawn into the body of the Pin, which can then be pulled out.

Case 1: Garden stage II fracture

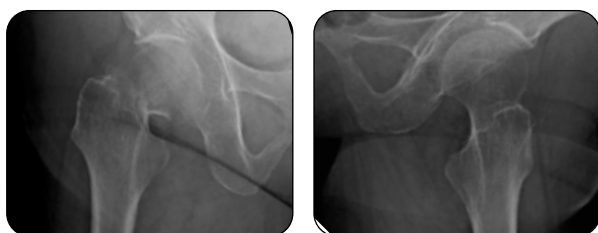


Preoperative

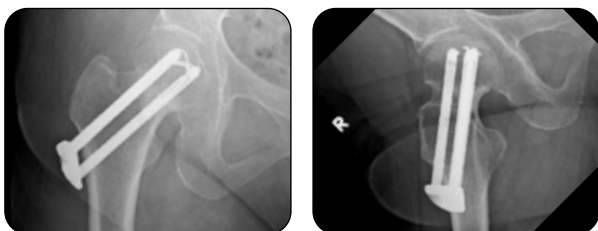


Postoperative

Case 2: Garden stage III fracture

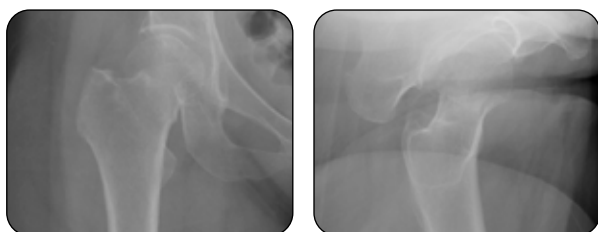


Preoperative

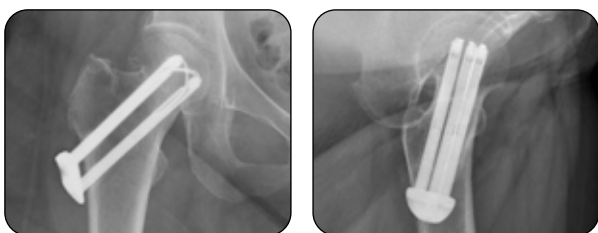


Postoperative

Case 3: Garden stage IV fracture



Preoperative



Postoperative

References

1. Brattgjerd, JE. Steen, H. & Strømsøe, K. (2020) Increased stability by a novel femoral neck interlocking plate compared to conventional fixation methods. A biomechanical study in synthetic bone. *Clinical Biomechanics* 76, 104995
2. Iwakura, T. Terashima, Y. Sakurai, A. & Sawamura, S. (2018) Short-term outcomes of osteosynthesis for undisplaced femoral neck fractures using Hansson Pin or Hansson Pinloc. *The Central Japan Journal of Orthopaedic Surgery & Traumatology*, 2018; 61: 1125-1126. (English translation is available on file at Swemac)
3. Matsushima, S. Takase, K. Sawauchi, K. & Waki, T. (2018) Clinical results of surgical treatment with Hansson Pinloc for femoral neck fracture. *Fracture, Japanese Society for Fracture Repair*, 40(2) 445-447. (English translation is available on file at Swemac)
4. Matsushima, S. Tanaka, S. Nakanishi, Y. Waki, T. & Yano, S. (2019) Clinical results of surgical treatment for displaced femoral neck fracture: Comparison of Hansson Pin and Hansson Pinloc in prospective study. *Fracture, Japanese Society for Fracture Repair*, 41(3) 901-905. (English translation is available on file at Swemac)
5. Yamazaki, K. Shiohara, K. Yamaguchi, M. Matsuoka, T. Kawahara, IL. & Hashimoto, T. (2018) Initial fixation after osteosynthesis of undisplaced femoral neck fracture with Hansson Pinloc System. *Fracture, Japanese Society for Fracture Repair*, 40(2) 437-440. (English translation is available on file at Swemac)
6. Iwakura, T. Yamamoto, Y. Negayama, K. Watanabe, S. Sakurai, A. & Sawamura, S. (2020) Hansson Pinloc can reduce reoperation rate in the treatment of undisplaced femoral neck fractures *Fracture, Japanese Society for Fracture Repair*, 42(2) 483-486. (English translation is available on file at Swemac)
7. Fukushima, H. (2019) Relationship between postoperative reduction position and head necrosis in non-dislocated femoral neck fractures undergoing osteosynthesis. *Chubu Seisai Journal*, 62, 127-128 (English translation is available on file at Swemac)
8. Yasuhara, Y. & Shoji, Y. (2019) Cases of poor results after treatment of undisplaced femoral neck fractures. *Fracture, Japanese Society for Fracture Repair*, 41(2). (English translation is available on file at Swemac)
9. Lindequist, S. Wredmark, T. Eriksson, SAV. & Samnegård, E. (1993) Screw positions in femoral neck fractures: Comparison of two different screw positions in cadavers. *Acta Orthopaedica Scandinavica*, 64(1), 67–70.
10. Lindeqvist, S. (1993) Cortical screw support in femoral neck fractures. A radiographic analysis of 87 fractures with a new mensuration technique. *Acta Orthopaedica Scandinavica* 64(3):289-93
11. Uta, S. Inoue, Y. Kaneko, K. & Iwase, H. (2000) Treatment of femoral neck fracture with Hansson Pins - A Biomechanical Study *Journal of Musculoskeletal System Vol. 13 No.5 May*. (English translation is available on file at Swemac)

12. Jönsson, A. Mellgren, M. & Theodorsson, J. (2010)
Analysis of Hansson Pinloc 2 for femoral neck fractures. The fracture gap modeled by a very elastic material.
12702.02.06-TR-01, XDIN® Develop and Deliver. (Data on file)
13. Jönsson, A. Mellgren, M. & Theodorsson, J. (2010)
Torsional rigidity of Hansson Pinloc 2 for femoral neck fractures.
2702.02.04-TR-01, XDIN® Develop and Deliver. (Data on file)
14. Nonomiya, H. (2018)
Osteosynthesis for Femoral Neck Fracture.
Joint Surgery Vol.37 No.9. (English translation is available on file at Swemac)
15. Loferer, M. (2015)
Push-in and pull-out test according to ASTM F543 - 13e.
Endolab Mechanical Engineering GmbH (Data on file)
16. Kusabiraki, Y. Yasuhara, Y. Ishiro, M. & Shoji, Y. (2017)
Comparison between Hansson Pin System and Hansson Pinloc System for displaced femoral neck fractures.
Fracture, Japanese Society for Fracture Repair, 39(4) 855-858. (English translation is available on file at Swemac)
17. Palm, H. Gosvig, K. Krashennikov, M. Jacobsen, S. & Gebuhr, P. (2009)
A new measurement for posterior tilt predicts reoperation in undisplaced femoral neck fractures.
Acta Orthopaedica, 80(3), 303–307.
18. Jönsson, A. & Lannergård, A. (2012)
Biomechanical test – Hansson Pinloc; standing and sitting case.
Elos Medtech, Sweden (Data on file)
19. Bergmann, G. Deuretzbacher, G. Heller, M. Graichen, F. Rohlmann, A. Strauss, J. & Duda, GN. (2001)
Hip contact forces and gait patterns from routine activities.
Journal of Biomechanics, 34(7), 859–871.
20. Brattgjerd, JE. Loferer, M. Niratisairaka, S. Steena, H. & Strømsøe, K. (2018)
Increased torsional stability by a novel femoral neck locking plate. The role of plate design and pin configuration in a synthetic bone block model.
Clinical Biomechanics, 55, 28–35.
21. Urata, Y. Hirai, T. & Fukumoto, T. (2017)
The treatment of femoral neck fracture with Hansson Pinloc.
Fracture, Japanese Society for Fracture Repair, 39(4) 859-862. (English translation is available on file at Swemac)
22. Kamenaga, T. Matsushima, S. Ito, K. Iga, M. Hayashi, N. & Onishi, Y. (2016)
The short term clinical results of internal fixation for displaced femoral neck fracture.
Chubu Seisai Journal, 59, 367-368. (English translation is available on file at Swemac)
23. Kawano, S. Kawakami, Y. Kaneoka, T. To, S. Tominaga, T. & Kido, K. (2018)
Clinical results of femoral neck fracture treated using Hansson Pin and Hansson Pinloc.
Chubu Seisai Journal, 61, 1121-1122. (English translation is available on file at Swemac)
24. Ragnarsson, JI. Hansson, LI. & Kärrholm, J. (1989)
Stability of femoral neck fractures - A postoperative roentgen stereophotogrammetric analysis.
Acta Orthopaedica Scandinavica, 60(3), 283–287.
25. Berkes, MB. Little, MT. Lazaro, LE. Cymerman, RM. Helfet, DL. & Lorch, DG. (2012)
Catastrophic failure after open reduction internal fixation of femoral neck fractures with a novel locking plate implant.
Journal of Orthopaedic Trauma, 26(10), e170–e176.
26. Körver, RJP. Wieland, AWJ. Kaarsemaker, S. Nieuwenhuis, JJ. & Janzing, HMJ. (2013)
Clinical experience, primary results and pitfalls in the treatment of intracapsular hip fractures with the Targon FN locking plate.
Injury, 44(12), 1926–1929.
27. Kyle, RF. Wright, TM. & Burstein, AH. (1980)
Biomechanical Analysis of the Sliding Characteristics of Compression Hip Screws.
The Journal of Bone and Joint Surgery. American volume, 62(8), 1308–1314.
28. Eschler, A. Brandt, S. Gierer, P. Mittlmeier, T. & Gradl, G. (2014)
Angular stable multiple screw fixation (Targon FN) versus standard SHS for the fixation of femoral neck fractures.
Injury, 45 Suppl 1, S76–S80.
29. Bray, TJ. Smith-Hoefer, E. Hooper, A. & Timmerman, L. (1988)
The displaced femoral neck fracture. Internal fixation versus bipolar endoprosthesis. Results of a prospective, randomized comparison.
Clinical Orthopaedics and Related Research, (230), 127–140.
30. Zlowodzki, M. Brink, O. Switzer, J. Wingerter, S. Woodall, J. Petrisor, BA. Kregor, PJ. Bruinsma, DR. & Bhandari, M. (2008)
The effect of shortening and varus collapse of the femoral neck on function after fixation of intracapsular fracture of the hip: a multi-centre cohort study.
The Journal of Bone and Joint Surgery. British volume, 90(11), 1487–1494.
31. Hatanaka, W. (2012)
Effect of reducing the intraoperative traction for osteosynthesis of femoral neck fracture.
Fracture, Japanese Society for Fracture Repair, 40(4) 998-1001. (English translation is available on file at Swemac)
32. Strömquist, B. & Hansson, LI. (1984)
Femoral head vitality in femoral neck fracture after hook-pin internal fixation.
Clinical Orthopaedics and Related Research, (191), 105 - 109.
33. Sevitt, S. & Thompson, RG. (1965)
The distribution and anastomoses of arteries supplying the head and neck of the femur.
The Journal of Bone and Joint Surgery. British volume, 47, 560–573.
34. Trueta, J. & Harrison, MH. (1953)
The normal vascular anatomy of the femoral head in adult man.
The Journal of Bone and Joint Surgery. British volume, 35-B(3), 442–461.
35. Lykke, N. Lerud, PJ. Strømsøe, K. & Thorngren, KG. (2003)
Fixation of fractures of the femoral neck. A prospective, randomised trial of three Ullevaal hip screws versus two Hansson hook-pins.
The Journal of Bone and Joint Surgery. British volume, 85(3), 426–430.
36. Kloen, P. Rubel, IF. Lyden, JP. & Helfet, DL. (2003)
Subtrochanteric fracture after cannulated screw fixation of femoral neck fractures: a report of four cases.
Journal of Orthopaedic Trauma, 17(3), 225–229.
37. Sensoz, E. Özkal, FM. Acar, V. & Cakir, F. (2018)
Finite element analysis of the impact of screw insertion distal to the trochanter minor on the risk of iatrogenic subtrochanteric fracture.
Proceedings of the Institution of Mechanical Engineers. Part H, Journal of engineering in medicine, 232(8), 807–818.

IFU

For the latest version of this Instruction For Use. Please visit:
download.swemac.com/Hansson-Pinloc-System

Swemac

Hansson Pinloc® 2

Manufacturer: **Swemac Innovation AB**

CE 0413



Cobolgatan 1 • SE-583 35 Linköping, Sweden

+46 13 37 40 30 • info@swemac.com

www.swemac.com

P102-28-1-20210413

Print date: 2021-04-13