Planning and executing total knee arthroplasty (TKA) with accuracy and efficiency: the first 578 cases using RI.INSIGHTS and Smith+Nephew Robotic technology

Discussion points

- Surgeons can analyze data to **inform a patient-specific surgical plan** to drive **better outcomes** and **greater operating room efficiency**
- Robotic-assisted TKA aims to **execute the plan more accurately** than conventional techniques
- RI.INSIGHTS and the CORI◊ Surgical System demonstrate a **high degree of accuracy and efficiency** in both the planning and executing phase of surgery

Introduction

When undergoing a total knee replacement, surgeon-controlled factors such as implant positioning, gap balancing, ligament tensioning and soft tissue preservation have, if planned or executed inaccurately, the potential to **negatively impact functional outcomes, implant stability and survivorship.**[1]

In line with many other surgical specialities, **robotic technology is increasingly being adopted in TKA** to deliver these technical objectives with **greater accuracy and reproducibility** compared with conventional techniques.[2,3] Similarly, data analytic platforms and tools are being increasingly adopted; analysing large data sets to glean valuable actionable **insights that advance healthcare and improve patients' lives.**[4]

RI.INSIGHTS and the CORI Surgical System are part of the Smith+Nephew Real Intelligence portfolio which aims to transform the standard of care by augmenting surgeon insight and experience with robotics, software and data to drive better patient outcomes. RI.INSIGHTS provides surgeons with the information required to drive optimal surgical planning followed by accurate execution of the plan using the CORI Surgical System.

Informed planning with RI.INSIGHTS

RI.INSIGHTS provides a secure data hub enabling health care professionals to search retrospective case data from both their own S+N robotic-assisted surgeries and those of other surgeons, to help **inform the patient-specific surgical plan.**

RI.INSIGHTS: how does it work?

Figure 1. RI.INSIGHTS view of global cases

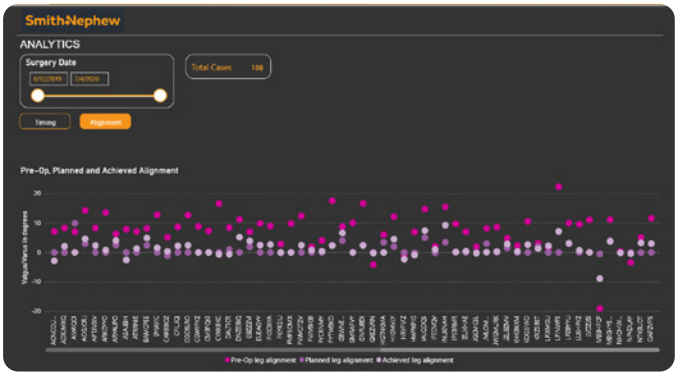


Figure 2. RI.INSIGHTS view of data trends

Step 1: Upload Robotic case data to the RI.INSIGHTS portal and view "Your Cases" or "Global Cases" to find patients with comparable preoperative values (Figure 1)

Step 2: Review case details to inform surgical plan for new patient. Execute surgical plan

Step 3: View data analytics postoperatively for trends in efficiency (time) and accuracy (alignment) (Figure 2)

Accurate and efficient execution of the surgical plan with CORI◊ Surgical System

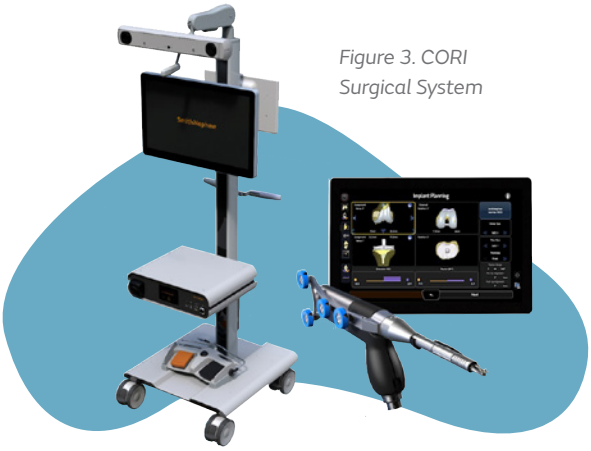


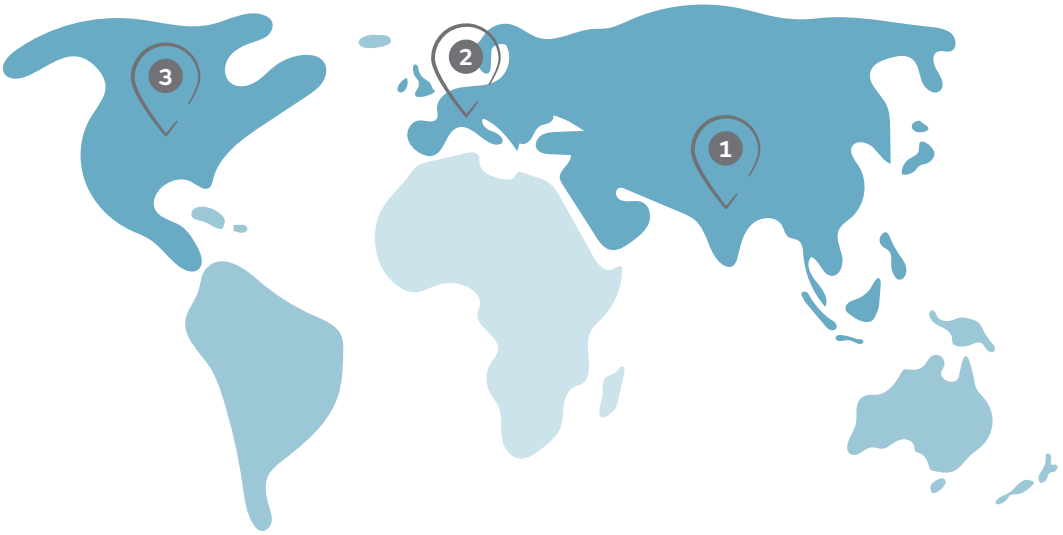
Figure 3. CORI Surgical System

Unlike other robotic systems, S+N's Robotic technology **eliminates the need for a CT scan** by using real-time, image-free smart mapping and gap assessment, which has been designed to **optimize implant position and balance.**

The new CORI Surgical System (Figure 3) is the latest handheld robotics system to evolve from the NAVIO◊ Surgical System, which has demonstrated **improved accuracy** compared to conventional techniques.[5,6,7] The CORI System's enhanced features improve surgical efficiency through fewer registration steps and a redesigned hand piece that delivers **precision milling at twice the cutting volume** of the NAVIO System.[8]

Early results from RI.INSIGHTS Global Pilot Programme

Results from the first 578 TKA cases using RI.INSIGHTS and S+N's Robotic technology from three geographical regions are presented (Figure 4).[9]



578 cases

6 surgeons

96 mean number of cases per surgeon

509 NAVIO TKAs

69 CORI TKAs

Figure 4. Geographical split of surgeons as part of the RI.INSIGHTS pilot programme

Accuracy of implant positioning

Of interest and in support of the concept of constitutional alignment,[10] the distribution of the natural alignment of the knee and the subsequent planned alignment of S+N Robotics TKAs from the RI.INSIGHTS pilot programme can be seen in Table 1.[9] In these cases, restoration of mechanical alignment to neutral, traditionally considered an important factor with respect to the durability of the implant following TKA, would seldom be desirable.

Table 1: Distribution of planned alignment based on preoperative deformity[9]

Preoperative	Mean planned alignment
Extreme Valgus (-3+); n=83	-1.42
Valgus (-3 to 0); n=67	-0.20
Neutral; n=0	N/A
Varus (0 to 3); n=93	0.41
Extreme Varus (3+); n=335	1.94

Robotic assisted surgery is associated with improved accuracy in implant positioning and limb alignment compared with conventional techniques.[5*] Using RI.INSIGHTS with S+N Robotic technology, **high levels of accurate component positioning** in relation to the plan were achieved (Figure 5).[9]

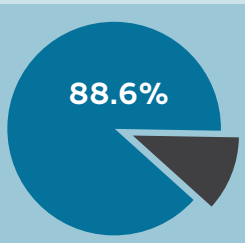


Figure 5. Percentage of S+N Robotic cases within 3 degrees of the planned alignment[9]

*with UKA robotic procedures

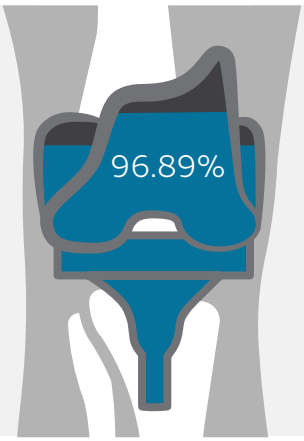


Figure 6. Percentage of S+N Robotic cases using RI.INSIGHTS which used the planned femur implant size[9]

Accuracy of planned implant size

Compared with conventional techniques, the planning capabilities of RI.INSIGHTS aims to support a more efficient operating room experience by reducing the need for unnecessary instrument trays, alignment guides, and cutting blocks, and reducing the need for multiple trialling.

In this pilot programme, 96.89% of cases used the planned femur implant size (Figure 6).[9] Knowing the optimum implant size and therefore the required instrumentation and trials ahead of the procedure, RI.INSIGHTS may help improve operating efficiencies.

Operating time

Existing studies show that **operative times are increased** in the learning phase of robotic TKA compared to conventional methods,[11] and **comparable between the two treatment techniques after the proficiency phase** (first 80 cases).[12]

RI.INSIGHTS can provide a step-by-step time analysis of the entire procedure. Overall, mean total operative time for the global pilot programme was 67.94 minutes, with a mean cutting time of 15.75 minutes.[9] A sub-analysis comparing the NAVIO◊ and CORI◊ Surgical Systems showed a **17% reduction in total operative time,**[9] demonstrating the improved efficiency of the latest technology (Figure 7)

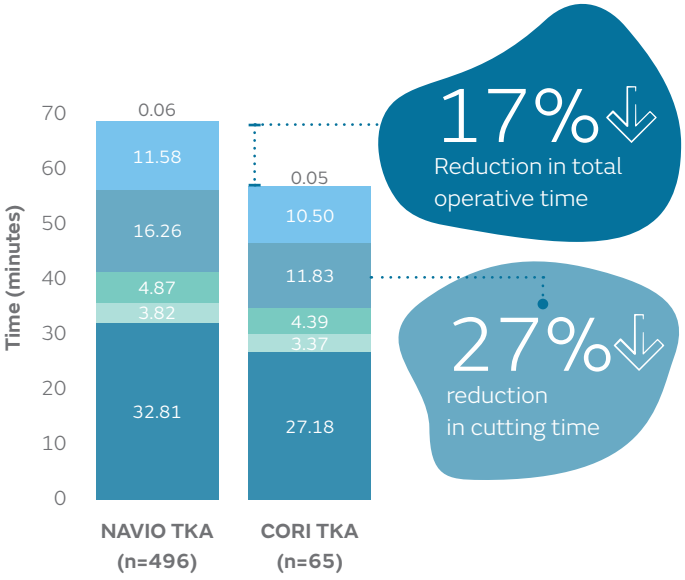


Figure 7. Comparison of mean time taken (minutes) for each stage of the TKA procedure using NAVIO or CORI Surgical System[9]

Conclusions

RI.INSIGHTS and the CORI Surgical System are part of the Real Intelligence portfolio, which aims to transform the standard of care in total joint arthroplasty. Early results from this pilot programme are promising and demonstrate a high degree of accuracy and efficiency in both the planning and execution phases of surgery, providing benefits to health care professionals and their patients.

References
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