



AI-Powered Surgical Instrument Verification Platform

Integrated Solution for Surgical Instrument Traceability, Verification, and Surgical Safety (RSI Prevention)

This proposal introduces the ClariTrace platform, designed to overcome the structural limitations of traditional surgical instrument management systems.

ClariTrace provides AI-based identification and verification of surgical instruments, enabling end-to-end traceability across CSSD, operating rooms, and hospital-wide workflows through a unified management framework.



CSSD

Central Sterile
Supply Department



CCDS

Loaner Instrument
Management



RSI Prevention

Retained Surgical Item
Prevention &
Surgical Safety Verification



Hospitals Manage Surgical Instruments, But Cannot Verify with Assurance



- Surgical instruments are generally managed as **sets (Set)** and organized according to surgical purposes.
- While this approach may be efficient in preparation and operation, it is unable to ensure the **accuracy of individual instruments** within the set.
- Instruments may be **lost or mixed** with other sets, and such issues are difficult to detect using conventional systems.
- Especially, **loaner instruments** are returned from external vendors and have varying configurations each time, making it **impossible to verify their accuracy**, which poses **patient safety risks**.

Set (Set) Unit Management (Standard Hospital Operation)



- ✓ Managed as a set unit
- ✓ Managed according to surgical purpose
- ✓ Ensures preparation and operational efficiency

Problems Inside the Set (Limitations of Existing Systems)

✗ Missing Instruments (Missing)



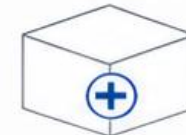
Essential instruments may be missing

✗ Mixed Instruments (Wrong)



Different instruments may get mixed

✗ Loaner Instrument Issues (Loaner)



Loaner / non-standard configurations cannot be verified





The existence of problems in the set may go unnoticed, making it impossible to verify the accuracy of individual instruments.


This Is Not Just an Operational Issue— It's a Patient Safety Risk





Patient safety risks can occur throughout the entire hospital workflow


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Loss, misplacement, or configuration errors of surgical instruments are not just operational issues—they are **patient safety risks** that can directly impact hospitals.
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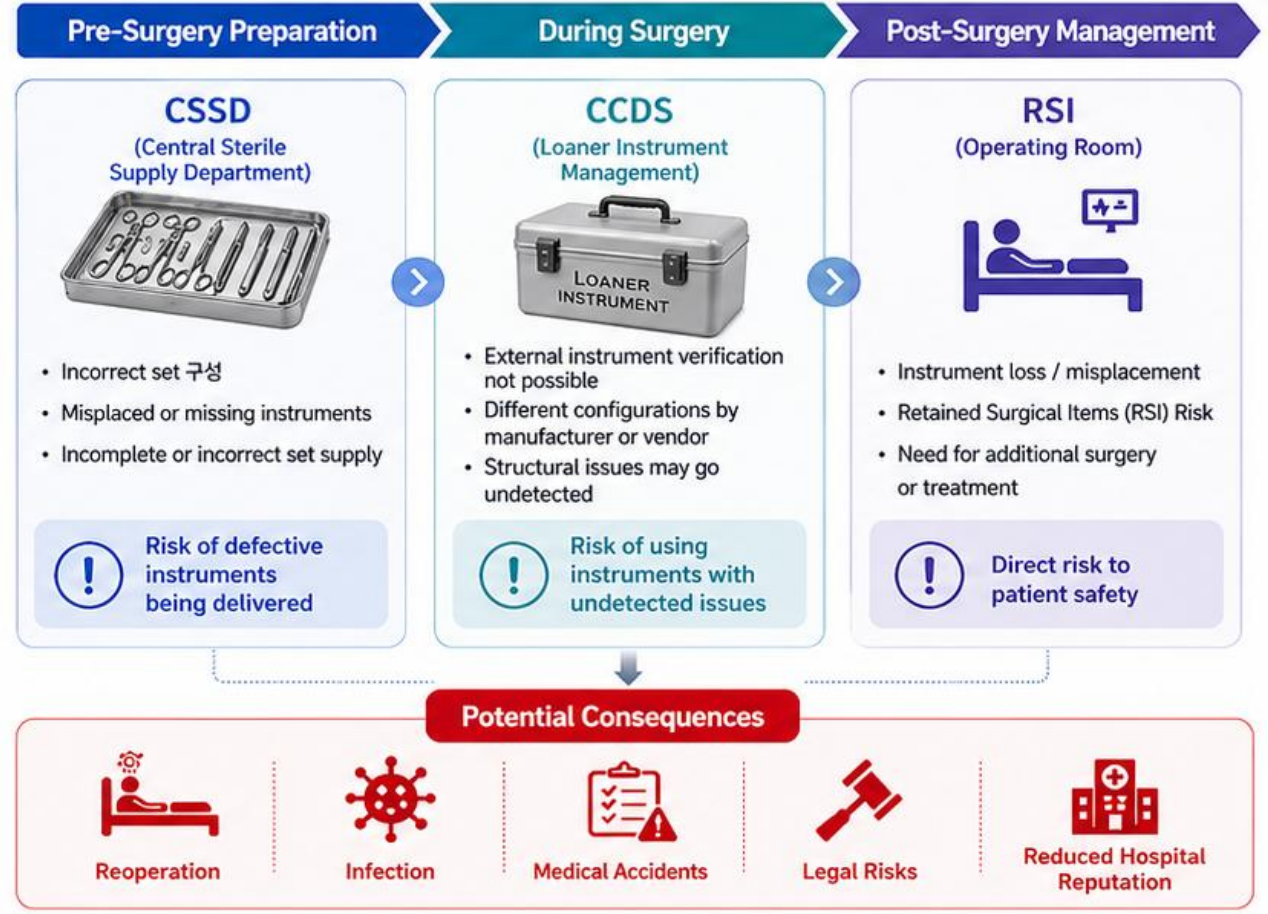
During the surgical preparation stage, incorrect sets or missing instruments may go unnoticed, which can lead to surgical delays and **compromise patient safety**.
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Especially for loaner instruments returned from external vendors, each set may have different configurations, making it difficult to verify completeness and **increasing the risk of structural problems**.
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If instruments are not accurately verified during surgery or at the end of the procedure, there is a risk of **retained surgical items (RSI)**, which may lead to serious legal, financial, and reputational consequences for the hospital.
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If instrument usage history is not clearly recorded and managed, it becomes **difficult to investigate the root cause** of incidents, limiting the hospital's ability to improve.
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Hospitals are ultimately responsible for these issues, and failure to address them may result in **damage that cannot be fully mitigated** through retrospective measures.



 **The challenges in surgical instrument management are directly connected to patient safety.** 

Existing Systems Cannot Solve This Problem

Hospital-based systems can support “management,” but they cannot provide “verification” with the accuracy that surgical instruments require.



CSSD (Central Sterile Supply Department)



Typical Approach

- Managed as a set unit
- Focus on assembly and packaging verification
- Based on barcode or manual records



✗ Limitations

- Cannot verify individual instruments within a set
- Cannot confirm presence of similar instruments
- Incomplete sets may still be supplied as if they are complete

CCDS (Loaner Instrument Management)



Typical Approach

- Depends on external vendor management
- Based on vendor supplied instrument lists
- Focus on check-in / check-out records



✗ Limitations

- Cannot verify instruments returned from external vendors
- Cannot confirm completeness of instrument components
- Structural differences may go undetected
- Cannot verify vendor configurations with absolute accuracy

RSI (Operating Room)



Typical Approach

- Visual inspection and count
- Double-check process
- Checklist-based verification



✗ Limitations

- Human judgment is prone to error
- Risk of instrument loss or retained surgical items (RSI)
- Real-time verification is difficult
- Root cause analysis is difficult in case of post-surgery issues



Existing hospital systems can “manage” but cannot “verify” with the required accuracy.





ClariTrace Provides “Verification,” Not Just “Management”

Traditional systems cannot ensure the accuracy of surgical instruments.

ClariTrace verifies the “accuracy” of surgical instruments in real time to ensure patient safety.




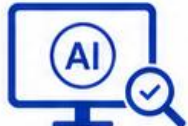



Existing Approach

Features		
 Set-Based Management Manage by set unit	 Manual Verification Check and record by person	 Partial Identification Barcode or manual-based identification
Limitations		
 Unable to Verify Set Contents Cannot verify accuracy of instruments within the set	 Unable to Verify Loaner Instruments Cannot verify accuracy of instruments on loan	 Unable to Verify Surgical Site Cannot verify accuracy of instruments for each surgical case

Issues may go unnoticed, making it impossible to verify accuracy.



ClariTrace Approach (Our Approach)

Features		
 Object-Based Management Manage by individual instrument	 AI Recognition + Verification AI real-time recognition and verification for accuracy	 Integrated Management across CSSD – Loaner – Operating Room End-to-end management from CSSD to Loaner to Operating Room
What It Enables		
 Individual Instrument Accuracy Verification Verify the accuracy of every instrument	 Automated Configuration Accuracy Check Automatically verify all set components in real time	 Complete Per-Surgery Verification Verify instrument accuracy for each surgical case

Verify What’s Right, with Accuracy.

 ClariTrace verifies “accuracy,” not merely “existence.”

 Not a management system, but a **patient safety verification system.**

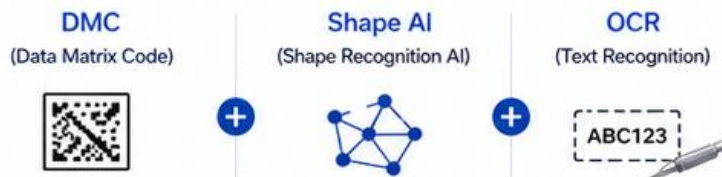
Why Only ClariTrace?

ClariTrace **overcomes** the fundamental limitations that existing systems cannot solve through its **unique technology, data structure, and process design.**



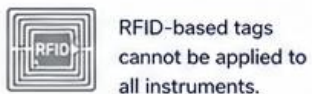
01 Hybrid Recognition Structure

A hybrid recognition structure capable of identifying all surgical instruments.



✓ **Accurately identifies engraved, non-engraved, damaged, and worn instruments.**

Overcoming Limitations of Existing Systems



RFID-based tags cannot be applied to all instruments.

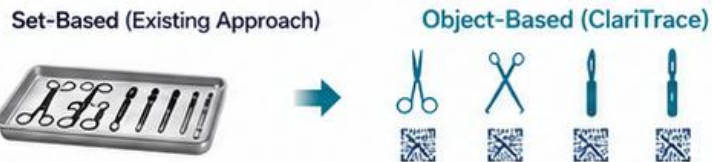


Vision-only (general AI) is susceptible to lighting, angles, and occlusion.

✗ **Only ClariTrace enables full instrument identification through a hybrid recognition approach.**

02 Object-Based Data Structure

Manage each instrument as a unique object unit.



- Set-level management
- Reliant on list-based control
- Cannot verify missing items within the set

- Individual instrument management
- Real-time identification and tracking
- Enables verification of missing or added instruments

Overcoming Limitations of Existing Systems



Cannot verify missing instruments within the set



Configuration errors cannot be detected



Cannot detect loaner instruments or duplicates

✓ **Improves accuracy and reliability through individual instrument unit management.**

03 Session Verification Structure

A unique system that verifies the completeness of surgery.



Overcoming Limitations of Existing Systems



Human judgment is prone to error



Difficult to detect during surgery or post-surgery



Incomplete checks can result in errors or omissions

✗ **Systems that verify the completeness of each surgery are unique to ClariTrace.**



ClariTrace provides not just technology, but a **“verification structure.”**



It doesn't just solve the limitations of existing systems, ClariTrace **fundamentally resolves** them through its unique structure.

ClariTrace Implementation Benefits

(Operational Efficiency • Cost Reduction • Patient Safety)

ClariTrace innovates the entire pre-processing workflow for surgical instrument management, enhancing operational efficiency, reducing costs, and ensuring patient safety.



01 Improve Operational Efficiency

Before	→	After
<p>Manual verification People rely on manual checks</p>		<p>Automated verification AI-powered auto verification and tracking</p>
<p>Set preparation time 15 minutes or more per set</p>		<p>Set completion time within 3–5 minutes 60–80% faster</p>
<p>Dependence on individuals Varying skill levels and inconsistencies</p>		<p>Standardized operation Anyone can operate accurately and consistently</p>

Results

Labor time reduced by
60–80%

Improved operational efficiency

02 Reduce Costs

Before	→	After
<p>Instrument loss Damage or loss due to misplaced instruments</p>		<p>Automated tracking Real-time tracking of instruments</p>
<p>Return Errors Costs incurred due to loaner instrument use</p>		<p>Accurate set composition Ensure only necessary instruments are included</p>
<p>Inefficient inventory management Excess inventory leading to increased costs</p>		<p>History-Based Management Prevent overstock and minimize excess inventory</p>

Results

Reduced instrument loss and damage costs

Reduced unnecessary purchases and overall costs

03 Enhance Patient Safety

Before	→	After
<p>Risk of missing instruments Potential risk of incomplete sets</p>		<p>Automated verification Verify all instruments exist and are tracked</p>
<p>Risk of retained surgical items (RSI) Potential risk of retained instruments</p>		<p>Verify the completeness of each surgical set Prevent missing or incomplete sets</p>
<p>Difficulty in tracing and identifying instruments Challenges in tracking instrument usage</p>		<p>Real-time tracking Track instrument usage in real time to quickly investigate any issues</p>

Results

Prevent RSI

Strengthen response to complications

Reduce medical risk and liability


ClariTrace improves operational efficiency, reduces costs, and enhances patient safety—

 Improving the 'cost structure' of hospital operations and the 'risk structure' of patient safety—at the same time.




Step-by-Step Adoption Tailored to Hospital Operations

ClariTrace maintains hospital workflow efficiency while expanding the scope of implementation in phases to enable **stable operations**.



 **ClariTrace goes beyond hospital operations—enabling **step-by-step adoption**.**

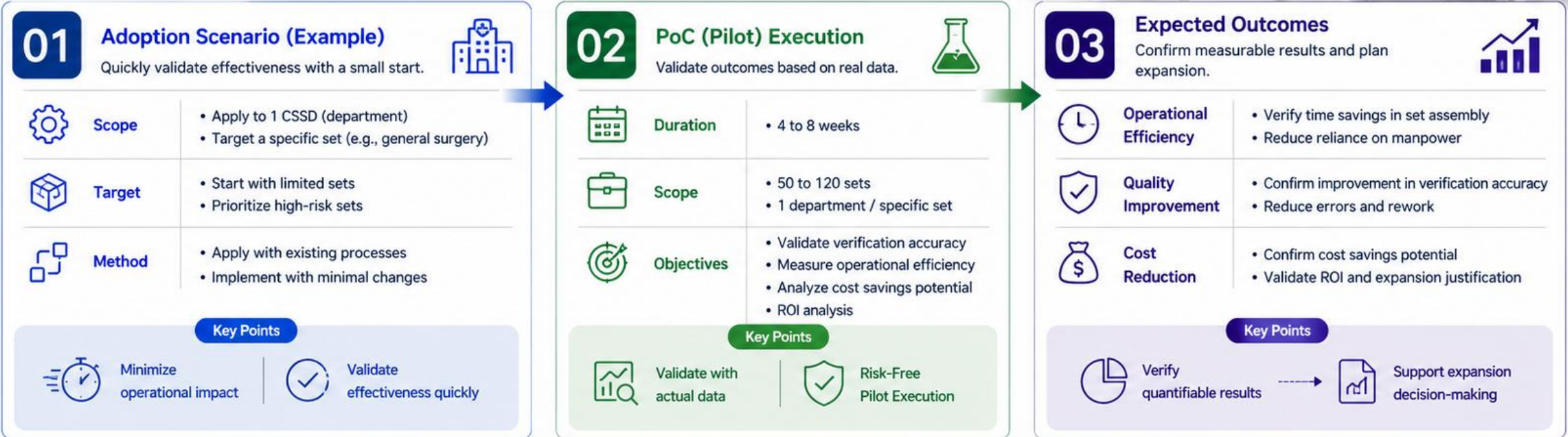
- Experience fast results from the early stages.
- Expand step by step to implement across the entire hospital.
- Achieve optimal fit for both hospital performance and workflows.

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Start Small to Verify, Expand with Confidence

ClariTrace validates outcomes through a Proof of Concept (PoC), enabling phased expansion with measurable results.



ClariTrace delivers proven results with a small start.

- Collect data-based outcomes to support data-driven decisions.
- Pilot results enable scalable adoption across the entire hospital.
- Ensure successful implementation for both hospital performance and workflow.

Pilot

>>>

Validate

>>>

Scale & Expand

A New Standard for Surgical Instrument Management, ClariTrace

In an era where the “**existence**” of surgical instruments is verified, we are moving to an era where “**accuracy**” is verified.



Accuracy

정확성

- Individual instrument unit identification and verification
- Eliminate set composition errors and missing or extra instruments



Accurate verification to create an error-free surgical environment



Safety

환자 안전

- Prevent and track retained surgical items (RSI)
- Strengthen infection control and patient safety



Build the most reliable hospital practice to prioritize patient safety



Control

운영 통제

- End-to-end instrument lifecycle management
- Improve data-driven operational efficiency



Maximize operational efficiency with complete visibility and control



ClariTrace sets a **new standard** for hospital operations.

The sooner you start, the greater the difference it makes.



We propose a tailored PoC (Pilot) optimized for your hospital.

Start verification today.