2023 WJTA Conference & Expo

October 30-November 1, 2023 • New Orleans, Louisiana

Paper

DEVELOPMENT OF FRAMEWORK FOR THE MANAGEMENT, HANDLING SYSTEM AND MAINTENANCE IN USING HYDROSURGERY AT HOSPITALS

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ABSTRACT

Waterjet machining (WJM) is an advanced material removal process where the material is removed by high velocity stream of water either with or without abrasive mixture depending on its specific application. Waterjet technology has advanced into the medical and health industries and slowly becoming popular for various surgical procedures. faster healing time, less bleeding, and prevention of thermo-mechanical damage, a waterjet is always sharp and clean are seen as advantages of using this technology. Many hospitals have found that using hydro surgery is technically, practically and economically feasible. Therefore, a well-structured routine for management and handling system, and maintenance were developed through an enhanced and comprehensive framework.

Keywords: waterjet machining, framework, management and handling system, maintenance

1. INTRODUCTION

In manufacturing operations, advanced machining techniques. water jet cutting has demonstrated to be a viable technology for machining a variety of materials. It is one of the fastest-evolving machining processes, and its application in the engineering sector changes and advances every year. Additionally, water jet technology is used in the medical industry for surgical treatments, wound cleaning, and dental procedures. Over time, water jet techniques have developed into cutting-edge tools in many different types of surgery. It can be used to carefully cut skin for any kind of surgery. The pressure and cut would simply be applied by moving the tool in a straight line. The primary benefit of a waterjet incision is its accuracy; it is just as efficient as a laser cutter. However, because of the waterjet's ability to cool, the split tissue is not thermally harmed by the incision's use.

Water jet technology can be used to resect tissues, tumours, the liver, and the kidney, clean traumatic wounds, release fat cells, save nerves and blood vessels, and remove dead skin in dermatology, cholecystectomy surgery, neurosurgery, ophthalmology, oncology, and dental applications [1]. Table 1 summarises some of the medicinal applications of waterjet cutting.

Overview of using waterjet in medicine [2]
Table 1

Type of Surgery	Operation Description	Benefits
Orthopaedic	Cutting endoprosthesis and bone	Below the critical temperature by cutting
Dental	Cutting and grinding of dental materials	Reduces the risk of jagged teeth and reduces the need for anesthesia
General	Resection of soft tissues: liver, gall bladder, brain, kidney, prostate, cleaning wounds	Blood vessels and nerve fibers remain in the defined pressure maintained, minimal bleeding, intact edges and precise cuts, lack of necrotic edge, reduce the duration of myocardial ischemia
Plastic	Cleaning skin grafts, removal of tattoos, liposuction	Separation of the layers of tissue, higher accuracy of results without edema and contour changes
Dermatology	Removing dead skin	Possibility of direct dose medications in a water jet
Oncology	Rectal cancer surgery with rectal dissection	Maximum radicality and excellent autonomic nerve preservation can be achieved with acceptable postoperative morbidity and low mortality

It is important to have a systematic framework in place for the maintenance of hydro surgery equipment in hospitals in order to ensure the equipment's proper operation and longevity. This can be done by developing a framework model for a suitable management and handling system for waterjet technology in surgical purposes. A well-structured framework model for a suitable management and handling system, as well as maintenance for the use of waterjet technology in hospitals is developed to ensure that the technical, practical and economic feasibility for hydro surgery is well established.

2. LITERATURE REVIEW

Waterjet cutting also known as hydro cutting, is an industrial process by which manufacturers can cut materials. The process uses a high-pressure stream of water [3]. A high-pressure water pump pressurises the water. This water flows through high-pressure tubing into the cutting head. In the cutting head, the water flows through a nozzle, turning it into an extremely fine stream. This stream cuts whatever material is placed in front of it [4]. Manufacturing has undergone a revolution since the 1940s, allowing manufacturers to once again meet the demands imposed on them by ever-more intricate designs and durability; nevertheless, in many cases, they were composed of materials that were nearly impossible to machine. This manufacturing revolution, like past ones, is currently centered on the utilization of new tools and energy sources. This has resulted in the introduction of new manufacturing processes used for material removal known today as advanced machining processes [5].

Machining is widely utilized in health care and is crucial to the procedure's efficacy and result. Several hydo surgery applications are extensively available, particularly in orthopaedic surgery, plastic surgery, neurology, dermatology, urology, and dental surgery. Dental drilling and root canal procedures necessitate significant milling, grinding, and drilling. Various Advanced Machining processes specialize in the production of medical devices, components, medical equipment, and implants for all parts of the profession, including diagnostics, therapy, and surgery [2]. Waterjet technology has recently been developed for use in medical applications, such as soft tissue resection, bone cutting, wound debridement, and surgery [6].

3. DEVELOPMENT OF FRAMEWORK FOR IMPROVED MANAGEMENT, HANDLING SYSTEMS AND MAINTENANCE

Developing a framework model for a suitable management and handling system for waterjet technology in surgical purposes involves a systematic approach that takes into account various factors:

1. Identifying the Objectives: The management and handling system for waterjet technology in surgical applications has clearly defined objectives. This may involve increasing surgical efficiency, lowering complications, increasing safety, maximizing resource use, and developing a more appropriate and well-structured maintenance and handling system.

2. Needs Assessment: A detailed needs assessment is undertaken to understand the present issues, requirements, and gaps in the current management and handling of waterjet technology in surgical settings. Consultation with important stakeholders such as surgeons, nurses, biomedical engineers, and hospital administrators is part of this assessment.

3. Reviewing Existing Guidelines and Regulations: The existing guidelines, standards, and regulations related to waterjet technology in surgical applications are familiarized. This include guidelines from professional bodies, regulatory authorities, and industry best practices.

4. Establishing a Multidisciplinary Team: A multidisciplinary team is formed comprised of healthcare professionals, engineers, researchers, and industry specialists. This team brings a variety of viewpoints and experience to the table in order to properly construct the framework model.

5. Defining System Requirements: The specific requirements for the management and handling system are defined based on the needs assessment and regulatory norms. Safety protocols, equipment maintenance, training processes, documentation, and quality assurance techniques are all taken into account.

6. Framework Model Design: A conceptual framework model is developed that specifies the major components, activities, and interactions of the management and handling system. This model should address the identified criteria while also aligning with the objectives defined in the initial stage.

7. Incorporating Risk Management: Risk management principles are incorporated into the framework model. Determine potential dangers connected with waterjet technology in surgical applications and develop mitigation techniques. This could include putting in place safety checks, creating standard operating procedures, and conducting frequent audits.

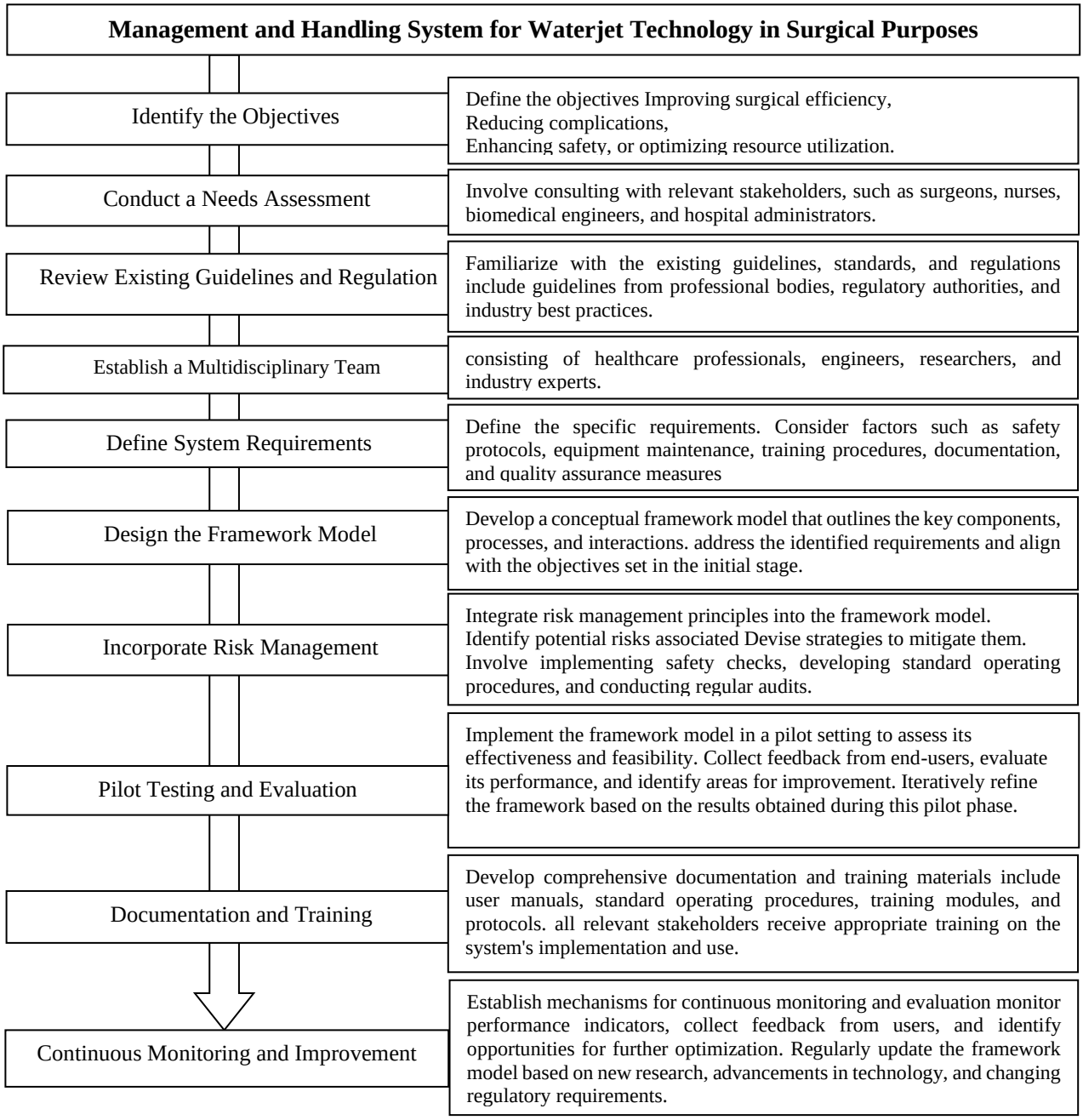
8. Documentation and Training: Develop comprehensive documentation and training materials for the management and handling system. User manuals, standard operating procedures, training modules, and protocols should all be included. All relevant parties were assured that they would receive adequate training on the system's deployment and use.

9. Continuous Monitoring and Improvement: Mechanisms are built for continual monitoring and assessment of the management and handling system. Performance indicators are monitored, user input is gathered, and opportunities for further optimization are recognized. The framework model, which is based on fresh research, technological improvements, and changing regulatory needs, must be updated on a regular basis.

4. RESULTS

4.1 FRAMEWORK FOR MANAGEMENT AND HANDLING SYSTEMS

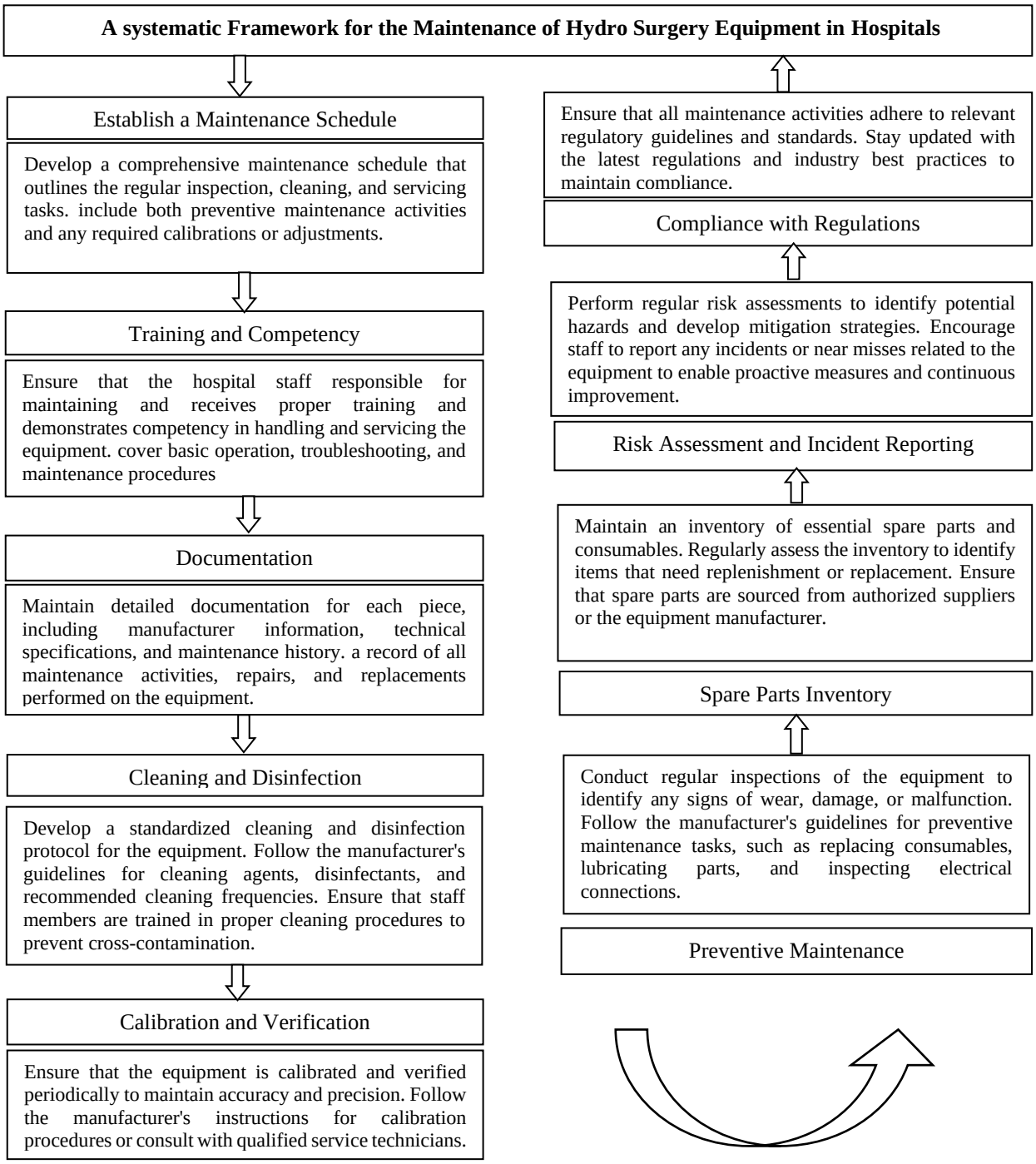
Developing a framework model for a suitable management and handling system for waterjet technology in surgical purposes involves a systematic approach that takes into account all necessary and relevant factors. The framework for the management and handling system is shown in Figure 1.



Framework for Management and Handling System for Waterjet Technology in Surgical Purposes
Figure 1

4.2 FRAMEWORK FOR MAINTENANCE

It is essential to have a systematic framework in place to ensure the proper functioning and longevity of the equipment. The framework for the maintenance is shown in Figure 2.



Framework of the maintenance of hydro surgery equipment in hospitals
Figure 2

5. CONCLUSION

The primary goal of this research was to create a thorough and systematic framework that can be used in hospitals that determine the practicality of using water jet technology into surgical procedures. By conducting a needs assessment, reviewing existing guidelines and regulations, forming a multidisciplinary team, defining system requirements, and creating the framework model, including risk management, pilot testing, evaluation, documentation, and training, as well as continuous monitoring and improvement, a well-structured framework model for an appropriate management and handling system for waterjet technology application in hospitals is developed. A well-structured framework model is created for adequate maintenance; this is required to maintain the correct operation and lifetime of the equipment by creating a maintenance schedule, as well as training and competency, documentation, preventive maintenance, calibration and verification, cleaning and disinfection, and spare parts. Inventory, vendor support, and service contracts, as well as risk assessment, incident reporting, and regulatory compliance, are all included.

6. ACKNOWLEDGEMENT

Appreciation to the Water Jet Technology Association (WJTA) for the scholarship award.

7. REFERENCES

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