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Evidence-Based Practice and Effectiveness Evaluation of Quality Management for Pre-Cleaning of Ophthalmic Precision Surgical Instruments

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ABSTRACT: Objective To summarize the best available evidence on quality management for the pre-cleaning of ophthalmic precision surgical instruments and translate it into practice, thereby improving awareness of evidence-based practice and the rate of evidence implementation, and ultimately enhancing the quality of pre-cleaning of ophthalmic precision instruments. **Methods** Based on the "6S" evidence model, the best available evidence from best-practice sources was retrieved and screened hierarchically, and 12 core pieces of evidence and 18 audit indicators were identified. On-site observation and record review were used to collect baseline data and post-implementation data, and the effects of evidence implementation were analyzed comparatively. **Results** Before evidence implementation, the implementation rates of indicators P2 (no use of normal saline intraoperatively), P4 (immediate immersion in water after use of viscoelastic agents), P9 (postoperative wiping of silicone oil-contaminated instruments), and P14 (daily high-level disinfection of reusable brushes) were 0 and increased to 63%~77% after implementation. The differences in implementation rates for audit indicators P1 (intraoperative on-site pre-cleaning), P3 (wiping with lint-free materials), P5 (flushing of the two lumens of phacoemulsification handpieces), P6 (surface wiping of phacoemulsification handpieces), and P7 (separate intraoperative placement of silicone oil-contaminated instruments) were statistically significant (P<0.05). Following the implementation of the evidence-based optimized pre-cleaning protocol for ophthalmic precision instruments, the pass rate for post-cleaning protein residue testing increased from 92% to 100%. **Conclusion** The implementation of evidence on quality management for the pre-cleaning of ophthalmic precision surgical instruments can enhance relevant staff members' awareness of the importance of pre-cleaning, standardize operating procedures, significantly improve the pass rate of instrument cleaning, and help ensure the safety of ophthalmic surgery.

KEY WORDS: ophthalmic precision surgical instruments; pre-cleaning; evidence implementation

In recent years, with advances in medical technology, ophthalmic microsurgery, which was initially introduced in the 1940s, has undergone substantial further development. It offers advantages such as precise surgical manipulation, minimal tissue damage, and favorable outcomes[1]. Ophthalmic precision surgical instruments are indispensable for performing microsurgery. With the development of ophthalmic specialty techniques, these instruments have become increasingly delicate and complex. Given their specialized structures and susceptibility to damage, inadequate cleaning and disinfection can readily lead to intraocular infection[2]. Previous studies have shown that approximately 20% of postoperative ocular infections are attributable to inadequate cleaning and sterilization of surgical instruments[3]. To date, multiple guidelines on the reprocessing of ophthalmic precision instruments have been issued both in China and internationally, covering requirements for the entire reprocessing process, including pre-cleaning, cleaning, packaging, and sterilization, and providing a solid evidence base for clinical practice[4]. In this study, we systematically searched for evidence, assessed the quality of the literature, extracted core

evidence, analyzed barriers in light of clinical practice, and developed and implemented an evidence-based pre-cleaning protocol for ophthalmic precision instruments tailored to the study hospital. The aim was to strengthen staff members' evidence-based thinking, improve the pass rate of instrument cleaning, and reduce the risk of postoperative infection[5].

1 Materials and methods

1.1 General information

This study was conducted at a tertiary general hospital. The hospital performs an average of 50 ophthalmic surgeries per day. The Central Sterile Supply Department (CSSD) has one workstation for manual cleaning of precision instruments and three automated cleaning machines for ophthalmic precision instruments. The department is responsible for the reprocessing of ophthalmic precision instruments, including instruments used for glaucoma surgery, cataract surgery, vitrectomy, and other procedures. The CSSD currently has 11 nurses and 25 technical staff. Before and after evidence implementation, the procedures were performed by staff specifically assigned to ophthalmic instruments to ensure consistency of practice.

1.2 Methods

This study was conducted in four stages: evidence synthesis, baseline audit, evidence implementation, and post-implementation audit. The core objective was to translate evidence-based findings into a clinically feasible pre-cleaning management protocol. The specific process was as follows:

1.2.1 Evidence summary

1.2.1.1 According to the "clinical application of evidence" model of the Joanna Briggs Institute (JBI) Centre for Evidence-Based Healthcare, the PIPOST (Population, Intervention, Professional, Outcome, Setting, Type of evidence) framework was used to formulate the evidence-based question. P: Reusable ophthalmic precision surgical instruments. I: I1 refers to pre-cleaning methods, and I2 refers to pre-washing methods. P: Staff of the CSSD (including nurses and technical staff), operating room nurses, and ophthalmic outpatient operating room nurses. O: O1 refers to the pass rate of cleaning of ophthalmic precision instruments (as assessed by visual inspection, ATP testing, and protein residue testing); O2 refers to nurses' awareness, acceptance, and implementation of knowledge regarding the cleaning of ophthalmic precision instruments; O3 refers to the management procedures and standards for the pre-cleaning of ophthalmic precision instruments. S: CSSD. T: Guidelines, evidence syntheses, systematic reviews, expert consensus statements, and primary studies.

1.2.1.2 Establishment of the evidence-based practice group. The evidence-based practice group consisted of eight members, including one head nurse, who was responsible for overall project coordination and facilitation and for supervising implementation; two deputy chief nurses, who were responsible throughout the project for evidence retrieval, analysis of audit materials, data collection, implementation of the audit indicators, and interdepartmental communication, as well as for developing and supervising the project implementation plan; four charge nurses, who were responsible for project implementation and data collection and collation; and one associate chief physician, who was responsible for project implementation and interdepartmental communication.

1.2.1.3 Evidence retrieval and screening. According to the "6S" evidence model[6] (Systems, Summaries, Synopses of Syntheses, Syntheses, Synopses of Studies, Studies), evidence was retrieved hierarchically from higher-level to lower-level sources. The sources searched included: ① guidelines and decision-support systems, including UpToDate, BMJ Best Practice, the National Guideline Clearinghouse (NGC), and the Chinese guideline website (https://guide.medlive.cn); ② evidence summaries and systematic reviews, including the JBI Evidence-Based Healthcare Center database, Cochrane Systematic Reviews, and the systematic review subset of PubMed; ③ primary studies, including those retrieved from PubMed (including MEDLINE), Embase, CBM, CNKI, Wanfang, and VIP. The search period was from database inception to March 12, 2024. A combination of subject headings and free-text terms was used. The Chinese search

terms included "ophthalmic instruments/precision instruments/surgical instruments", "pre-treatment/bedside processing/moisturization", and "cleaning/disinfection/sterilization/quality"; The English search terms included "ophthalmic surgical instruments/microsurgical instruments", "pre-treatment/pre-cleaning/bedside cleaning", and "cleaning/sterilization/decontamination". All included literature was appraised for methodological quality using internationally recognized appraisal tools. Guidelines were appraised using the AGREE Ⅱ instrument. Both guidelines scored ⩾ 80% in the three domains of "Scope and Purpose", "Stakeholder Involvement", and "Rigor of Development", and received an overall rating of "Grade A (recommended)"; Expert consensus statements were appraised using the JBI Checklist for Text and Opinion, which comprises six items. All items for both consensus statements were rated "Yes", indicating relatively high methodological quality; Randomized controlled trials (RCTs) were appraised using the Cochrane risk-of-bias tool. Both RCTs were rated as having a low risk of bias in random sequence generation, allocation concealment, and blinding of outcome assessment. Only participant blinding was rated as "high risk" because blinding could not be implemented due to the characteristics of the instruments. However, the overall risk of bias was considered acceptable, and the studies were included. The quality appraisal was independently conducted by two researchers trained in evidence-based practice. Any disagreements were resolved through discussion or adjudicated by a third researcher. A total of two guidelines[7-8], two expert consensus statements[9-10], and two randomized controlled trials[11-12] were ultimately included. The included evidence was graded and assessed for feasibility, appropriateness, meaningfulness, and effectiveness (FAME). A total of 12 pieces of evidence (E1-E12) were ultimately adopted, based on which 18 practice indicators (P1-P18; P standing for "practice indicator") were developed. Each indicator was assessed using the corresponding method.

Table 1 Evidence Content and Audit Indicators

Evidence No.	Evidence content	Audit indicator No.	Audit indicator
E1	Instruments used for intraocular surgery should undergo pre-cleaning at the point of use.	P1	Instruments used for intraocular surgery should undergo pre-cleaning at the point of use.
E2	During surgery, surgical instruments should be wiped as soon as possible using a sterile solution and sterile, non-linting cloths or sponges. Normal saline must not be used.	P2	During surgery, surgical instruments should be wiped as soon as possible using a sterile solution other than normal saline.
		P3	During surgery, non-linting cloths should be used to wipe the surgical instruments.
E3	After use with viscoelastic agents, instruments should be immediately immersed in sterile water.	P4	After use with viscoelastic agents, instruments should be immediately immersed in sterile water.
E4	After use, reusable tubing and lumened instruments (including intraoperative irrigation tubing and curved needles) should be immediately flushed with sterile water.	P5	After use, reusable tubing and lumened instruments (including intraoperative irrigation tubing and curved needles) should be immediately flushed with sterile water.
E5	With a syringe, the surgical assistant should first aspirate back, then draw up sterile distilled water, connect the syringe to the aspiration and irrigation ports of the phacoemulsification handpiece, and flush twice. The outer surface of the phacoemulsification handpiece and the power cord should be wiped with non-linting moist gauze.	P6	With a syringe, the surgical assistant should first aspirate back, then draw up sterile distilled water, connect the syringe to the aspiration and irrigation ports of the phacoemulsification handpiece, and flush twice.
		P7	The outer surface of the phacoemulsification handpiece and the power cord should be wiped with non-linting moist gauze.

续表

Evidence No.	Evidence content	Audit indicator No.	Audit indicator
E6	The handling of surgical instruments contaminated with silicone oil should begin in the operating room. During surgery, the operator should keep instruments that have come into contact with silicone oil separate to prevent contamination of other instruments. After surgery, residual silicone oil and other visible contaminants on the instrument surfaces should be wiped off with gauze moistened with distilled water.	P8	During surgery, the operator should keep instruments that have come into contact with silicone oil separate to prevent contamination of other instruments.
		P9	After surgery, residual silicone oil and other visible contaminants on the instrument surfaces should be wiped off with gauze moistened with distilled water.
E7	Keep the instruments moist before starting the cleaning process.	P10	Keep the instruments moist before starting the cleaning process.
E8	Ophthalmic instruments should be cleaned separately from other surgical instruments. Ophthalmic instruments should not be loaded together with other surgical instruments.	P11	Ophthalmic instruments should be cleaned separately from other surgical instruments.
		P12	Ophthalmic instruments should not be loaded together with other surgical instruments.
E9	Cleaning tools, such as syringes and cleaning brushes, should be single-use. If cleaning brushes are reusable, they should be cleaned after each use and undergo high-level disinfection or sterilization at least once daily.	P13	Cleaning tools, such as syringes and cleaning brushes, should be single-use.
		P14	If cleaning brushes are reusable, they should be cleaned after each use and undergo high-level disinfection or sterilization at least once daily.
E10	Enzymatic or alkaline detergents may be selected as appropriate. They should be used in accordance with the manufacturer's instructions, prepared immediately before use, and replaced after each use. The use of care agents or lubricants is not recommended.	P15	Enzymatic or alkaline detergents may be selected as appropriate. They should be used in accordance with the manufacturer's instructions, prepared immediately before use, and replaced after each use. The use of care agents or lubricants is not recommended.
		P16	Detergents should be prepared immediately before use and replaced after each use.
E11	Surgical instruments contaminated with blood or silicone oil should first be soaked in an alkaline detergent and then ultrasonically cleaned with a multi-enzymatic detergent.	P17	Surgical instruments contaminated with blood or silicone oil should first be soaked in an alkaline detergent and then ultrasonically cleaned with a multi-enzymatic detergent.
E12	The cleaning solution should be discarded after each use and must not be reused.	P18	The cleaning solution should be discarded after each use and must not be reused.

1.2.2 Baseline audit. The baseline audit was conducted from June 3 to 28, 2025. Members of the evidence-based practice group conducted a comprehensive audit of the pre-cleaning of ophthalmic precision surgical instruments at the hospital in accordance with the established audit indicators and testing methods, recorded the implementation rate for each indicator, and analyzed the key problems and barriers identified.

1.2.3 Evidence implementation. Based on the baseline audit results, the team members discussed the barriers to implementing evidence on the quality management of ophthalmic precision instrument cleaning in the department and developed solutions based on the department's actual circumstances to translate the evidence into clinical practice. The specific measures were as follows: (1) Strengthen specialized training to improve awareness. The baseline audit showed that the relevant staff had insufficient knowledge of pre-cleaning of ophthalmic precision instruments. The key barrier was that pre-cleaning training had not been incorporated into the department's routine training program. Improvement measures: Incorporate knowledge related to pre-cleaning (including its importance, operating methods, and standardized procedures) into the department's annual

training plan; regularly conduct focused lectures and hands-on training; and include staff knowledge assessment in performance evaluations to ensure effective implementation of the training. (2) Improve the pre-cleaning procedures and quality standards for selected ophthalmic precision instruments in accordance with the evidence, such as the pre-cleaning procedure for phacoemulsification handpieces and the pre-cleaning procedure for ophthalmic surgical instruments contaminated with silicone oil, and incorporate instrument pre-cleaning into routine weekly quality control. The audit results showed that the department lacked pre-cleaning procedures for some special instruments and corresponding quality assessment criteria, and that quality control of pre-cleaning in the department was relatively inadequate. (3) Standardize bedside pre-cleaning procedures: Immediately after ophthalmic surgery, remove debris and soil from the instruments, particularly hollow instruments. Postoperative bedside handling differed from the evidence-based recommendations. The barrier was the lack of prior evidence-based research, resulting in a lack of evidence-based guidance for postoperative handling methods. The improvement measure was for the evidence-based practice group to develop postoperative pre-cleaning procedures. Specifically, immediately after surgery, residual contaminants on surgical instruments were removed with distilled water in the operating room. For example, the lumen of the phacoemulsification handpiece was pre-flushed using the phacoemulsification system, and contaminants were removed from the instrument surface. (4) Keep ophthalmic precision instruments moist after surgery if they cannot be promptly sent to the CSSD for processing. Before evidence implementation, instruments that could not be promptly sent to the CSSD for processing after surgery did not undergo standardized pre-cleaning or moisture-retention procedures. The barriers included the fast-paced workflow in the operating room and the multiple tasks performed during surgery; the considerable distance between the two hospital campuses; and inadequate supplies for pre-cleaning. The improvement measures were to immediately immerse the instruments in a 1∶200 enzymatic solution after surgery to prevent soil from drying on the instrument surfaces and to provide dedicated containers. Following communication and coordination between the operating room and the CSSD, the logistics schedule was adjusted and the frequency of instrument collection was increased to ensure that used instruments could be kept moist or promptly sent to the CSSD for processing. (5) Conduct quality testing of pre-cleaning and cleaning of ophthalmic precision instruments. Protein residue testing was performed on pre-cleaned instruments before and after evidence implementation. The results showed that pre-cleaning quality was significantly improved after evidence implementation, with a cleaning pass rate of 100% in both periods. The barriers were inadequate implementation of postoperative pre-cleaning and the absence of a soaking step before cleaning. The improvement measures were to strictly implement the postoperative pre-cleaning procedures; send the instruments to the CSSD for processing as early as possible; and routinely soak and rinse the instruments in an enzymatic solution before loading them into the washer for cleaning, thereby ensuring the quality of pre-cleaning and the cleaning pass rate.

1.2.4 Post-implementation audit. The evidence implementation period was 2 months. From October 7 to 30, 2025, the same methods, indicators, and testing criteria as those used in the baseline audit were applied to comprehensively audit the pre-cleaning of ophthalmic surgical instruments in 30 cases across the two hospital campuses and the implementation of the indicators by 15 relevant nurses. The effects of evidence implementation were then comparatively analyzed.

1.3 Statistical analysis. Data were independently entered and cross-checked by two researchers using Excel 2021, and statistical analyses were performed using SPSS 26.0. Categorical data were expressed as numbers (percentages), and between-group comparisons were performed using the Pearson χ^2 test for 2×2 contingency tables. Fisher's exact test was used when the expected frequency in any cell was <5. All

hypothesis tests were two-sided, with a significance level of α=0.05. For implementation rate indicators, the denominator was the total number of cases (sets of surgical instruments) or persons (nurses) included in the same audit, and the numerator was the number of compliant cases or persons. The positive rate of protein residue was calculated as follows: Positive rate= (number of instruments positive for protein residue/total number of instruments tested)×100%.

2 Results

2.1 Comparison of audit indicator implementation rates before and after evidence implementation

Following evidence implementation, in October 2025, the on-site handling and pre-washing of ophthalmic surgical instruments in 30 cases across the two hospital campuses were audited, and the implementation of each indicator by nurses (n=15) was assessed individually. The implementation rates of all audit indicators were significantly higher than at baseline. In particular, the implementation rates of P2 (no use of normal saline intraoperatively), P4 (immediate immersion in water after use of viscoelastic agents), P9 (postoperative wiping of silicone oil-contaminated instruments), and P14 (daily high-level disinfection of reusable brushes) increased from 0 to 63%~77%. The increases in the implementation rates of audit indicators P1 (intraoperative on-site pre-cleaning), P3 (wiping with lint-free materials), P5 (flushing of the two lumens of phacoemulsification handpieces), P6 (surface wiping of phacoemulsification handpieces), and P7 (separate intraoperative placement of silicone oil-contaminated instruments) were statistically significant (P<0.05). The five core indicators, P12 (separate loading of ophthalmic instruments), P15 (appropriate selection of detergents), P16 (fresh preparation and immediate use of detergents), P17 (soaking of silicone oil-contaminated instruments in an alkaline enzymatic solution), and P18 (single use of cleaning solutions), maintained implementation rates of 100% (see Table 2).

2.2 Comparison of protein residue detection results before and after evidence implementation

Before evidence implementation, a total of 60 ophthalmic precision instruments were tested (two representative instruments were randomly selected from each of 30 sets of surgical instruments). The protein residue positivity rate after pre-cleaning was

Table 2 Comparison of Implementation Rates of Audit Indicators Before and After Evidence Implementation

Audit indicator	Before evidence implementation		After evidence implementation		χ^2	P value
	Number of compliant cases	%	Number of compliant cases	%		
P1	10	33	28	93	23. 25	<0. 001
P2	0	0	23	77	—	0. 011
P3	8	27	20	67	8. 571	0. 003
P4	0	0	22	73	—	0. 005
P5	5	17	22	73	18. 947	<0. 001
P6	12	40	21	70	4. 286	0. 038
P7	8	27	26	87	18. 000	<0. 001
P8	26	87	28	93	0. 741	0. 389
P9	0	0	23	77	—	0. 011
P10	6	20	25	83	22. 222	<0. 001
P11	22	73	26	87	0. 741	0. 389
P12	30	100	30	100	—	—
P13	8	27	19	63	9. 524	0. 002
P14	0	0	19	63	—	<0. 001
Indicators P15−P18	30	100	30	100	—	—

Note: The sample size for each audit indicator was n=30. For P2, P4, P9, and P14, the baseline number of compliant cases was 0; Fisher's exact test was therefore used, and no χ^2 statistic was calculated. For P12, the implementation rate was 100% both before and after evidence implementation; therefore, no statistical test was performed. The remaining indicators were analyzed using Pearson's χ^2 test.

83% (50/60), which decreased to 50% (30/60) after evidence implementation; the difference was statistically significant (χ^2=15.0, P<0.001). The pass rate for protein residue detection after cleaning increased from 92% (55/60) before evidence implementation to 100% (60/60) after evidence implementation; the difference was statistically significant (one-sided Fisher's exact, P=0.029).

3 Discussion

3.1 An evidence-based standardized protocol can significantly improve evidence implementation rates

The results of this study showed that the evidence-based pre-cleaning protocol for ophthalmic precision instruments can effectively improve staff implementation of the evidence and standardize the pre-cleaning management of reusable ophthalmic precision surgical instruments. Compared with routine clinical practice, the 18 audit indicators in this study are not simply additional procedural steps but key quality control points identified based on the specific characteristics of ophthalmic precision instruments. Routine practice often relies on individual experience and lacks uniform, detailed standards, making it easy for high-risk steps, such as "wiping with normal saline" and "failure to promptly rinse off residual viscoelastic", to be overlooked. Through evidence-based practice, this study translated these key points that are easily overlooked in routine workflows into standardized indicators that can be implemented and audited, effectively addressing gaps in routine management. Before evidence implementation, the implementation rates of audit indicators P2 (no use of normal saline intraoperatively), P4 (immediate immersion in water after use of viscoelastic agents), P9 (postoperative wiping of silicone oil-contaminated instruments), and P14 (daily high-level disinfection of reusable brushes) were 0. The main reasons were the lack of standardized protocol guidance and systematic training, as well as insufficient staff awareness of the importance of pre-cleaning. After evidence implementation, the implementation rates increased to 63%~77%. The increases in the implementation rates of audit indicators P1 (intraoperative on-site pre-cleaning), P3 (wiping with lint-free materials), P5 (flushing of the two lumens of phacoemulsification handpieces), P6 (surface wiping of phacoemulsification handpieces), and P7 (separate intraoperative placement of silicone oil-contaminated instruments) were statistically significant (P<0.05). Five indicators (P12, P15, P16, P17, and P18) maintained an implementation rate of 100%. These findings indicate that integrating evidence into clinical practice can promote a shift in pre-cleaning practices from an "experience-based" approach to a "standardized" approach, thereby improving management effectiveness.

3.2 The evidence-based pre-cleaning protocol can effectively improve instrument cleaning quality

In this study, an evidence-based pre-cleaning management protocol for ophthalmic precision instruments was developed, resulting in improved cleaning quality and an increase in the pass rate for protein residue detection from 92% to 100%. Postoperative bedside pre-cleaning was performed in accordance with the evidence-based protocol. Phacoemulsification handpieces and instruments contaminated with silicone oil underwent step-by-step pre-cleaning according to the protocol, ensuring that the pre-cleaning of instrument surfaces and lumens met the required standards. Instruments that could not be promptly sent to the Central Sterile Supply Department (CSSD) for processing were kept moist. Before cleaning, CSSD staff followed the protocol by soaking the instruments before placing them in the washer, thereby ensuring the cleaning pass rate. Ensuring the quality of ophthalmic instrument management is an important means of reducing healthcare-associated infections in patients[13].

3.3 Evidence implementation can strengthen quality and safety awareness among multidisciplinary staff

Due to the complex anatomy of the eye and the high technical demands of ophthalmic surgery, ophthalmic surgical instruments have small, delicate working ends and often contain narrow lumens and crevices, making them highly susceptible to retaining organic matter after surgery[14]. Ophthalmic surgery is fast-paced, and the instruments are difficult

to clean. Failure to clean them promptly or improper cleaning can readily result in protein residues on instrument surfaces, forming a biofilm that harbors microorganisms, which can compromise subsequent disinfection and substantially increase the risk of postoperative infection[15]. By establishing and fostering collaboration within a multidisciplinary evidence-based practice team, this study broke down departmental barriers and strengthened cross-departmental communication and coordination. Through targeted training and assessment, awareness of the importance of pre-cleaning among surgeons, nurses, and CSSD staff was enhanced, enabling them to master standardized operating procedures and improving implementation. At the same time, the evidence-based practice process fostered evidence-based thinking among staff and promoted a shift from "passive implementation" to "proactive optimization". Combined with tools such as failure mode and effects analysis (FMEA), this approach can further reduce potential risks in the pre-cleaning process and provide strong support for establishing a sustainable quality and safety management system.

3.4 Strengths and limitations of this study

The main strengths of this study are as follows: (1) It strictly followed the JBI model for clinical application of evidence, establishing a closed-loop evidence-based management pathway from question formulation and evidence retrieval to evidence implementation, with high methodological reproducibility; (2) It combined implementation rates with objective protein residue testing, avoiding the limitations of relying solely on process or outcome indicators; (3) The multidisciplinary collaboration model effectively broke down professional barriers and provided a reference for subsequent cross-departmental quality improvement. This study also has some limitations, including: (1) its single-center design and relatively small sample size (30 cases before and 30 cases after evidence implementation), which limit the generalizability of the findings; (2) The post-implementation audit period was relatively short (2 months), and the long-term sustainability of the effects and any decline in adherence require further observation; (3) Although the implementation rates of some indicators (P2, P4, P9, and P14) increased significantly after evidence implementation compared with baseline (from 0 to 63%~77%), they did not reach 100%, mainly due to objective factors such as the fast pace of ophthalmic surgery, heavy workloads, and staffing constraints. Further efforts are needed to continuously optimize the workflow and strengthen supervision.

4 Conclusion

In this study, evidence related to the quality management of pre-cleaning for ophthalmic precision surgical instruments was systematically retrieved and screened, and the methodological quality of the literature was quantitatively appraised. An evidence-based practice protocol was developed and implemented based on clinical practice, effectively standardizing pre-cleaning procedures, improving relevant staff members' awareness of evidence-based practice and implementation rates, significantly enhancing instrument cleaning quality, and reducing the potential risk of postoperative infection. However, this study has some limitations. The implementation rates of some evidence-based practices did not reach 100% after implementation, owing to objective factors such as departmental space, staffing, and work pace. Further efforts are needed to continuously analyze barriers, optimize improvement measures, and promote the deep integration of evidence and clinical practice. In the future, the practical work of the Central Sterile Supply Department should be further taken into account, the evidence base should be updated dynamically, and pre-cleaning management procedures and the quality control system should be improved to continuously enhance the quality of pre-cleaning for ophthalmic precision surgical instruments and provide stronger assurance of ophthalmic surgical safety.

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