

A Comparative Study to Find Different Cleaning Solutions Effectivity of Protein Deposits Buildup of Ocular Prosthesis

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ABSTRACT

Background: This study aimed to comparatively evaluate the effectiveness of two different cleaning solutions, Johnson's Baby Shampoo (Solution A) and Pro-Master Cleaning Solution (Solution B), in removing protein deposits from ocular prostheses.

Methodology: Forty six patients using ophthalmic prostheses participated in this comparative study. Each patient was provided with two identical, new ophthalmic prostheses for a specified period of three months. Patients were instructed to use one prosthesis and clean it once a month using Johnson's Baby Shampoo (Group A) and to use the other prosthesis and clean it once a month with Pro Master Solution (Group B), following the specific instructions for each cleaning solution. To minimize bias, the assignment of cleaning solutions to prostheses was randomized for each patient. After the specified period, both prostheses were collected from each patient. The amount of protein deposit buildup on each prosthesis was then measured.

Results: The results showed a t-value of 13.60, with an associated p-value of less than 0.00001. Given that the p-value is significantly lower than the conventional alpha level of 0.05, the difference between the two groups is considered statistically significant. This implies that the observed difference in mean deposit scores is unlikely to have occurred by chance. The pooled variance was calculated as 0.21, and the variance of the mean for each group was 0.01, based on a sample size of 23 in each group. The observed mean difference between the two groups (1.84 units on a 0–10 grading scale) yielded a t-score far above the critical threshold, indicating a large effect size and a strong difference in cleaning performance between the two polishing solutions. Therefore, it can be concluded that Solution B (Pro-Master Cleaning Solution) demonstrated significantly higher efficacy in reducing protein deposits on ocular prostheses compared to Solution A (Johnson's Baby Shampoo). These findings support the use of specialized prosthetic cleaning agents for improved hygiene and patient comfort.

Conclusion: We recommend that the Pro-Master Solution standard be the minimum standard of finish for prosthetic eyes. This standard may assist the smooth action of the lids over the interpalpebral zone of the prosthesis and the cleansing action of tears. The presence of deposits in the retro palpebral zone may improve the lubricating properties of socket fluids which, in turn, may result in less frictional irritation of the conjunctiva and less mucoid discharge

Keywords: Prosthetic eye, Deposits, Wettability, Mucoid discharge, cleaning solution

INTRODUCTION

Ocular Prosthesis

Ocular prosthesis is an artificial eye, which is implanted in patients with absence of eyeball due to congenital causes or in patients who have lost their eyes, due to various causes such as trauma, post-surgery, retinoblastoma, or in patients with no visual potential. (Pine et al., 2012).

Shrunken Eye (Phthisis Bulbi)

Congenital Or Acute Absence Eyes (Anophthalmia)

Congenital Small Sized Eyes (Microphthalmia)



Fig No. 1 Microphthalmia

Shrunken Eye (Phthisis Bulbi)

A shrunken eye or phthisical eye is a severely damaged and non-functional eye that has undergone shrinkage and atrophy. The globe (eyeball) becomes smaller and irregular in shape, often with scarring and calcification.



Fig No 2. Anophthalmia with Ocular Prosthesis

Cause	Description
Severe trauma	Blunt or penetrating injury damaging internal eye structures
Chronic inflammation or infection	Long-standing uveitis, endophthalmitis, or untreated infections
End-stage glaucoma	Long-term high intraocular pressure leading to destruction of eye tissues
Retinal detachment (untreated)	Can cause progressive atrophy of intraocular structures
Post-surgical complications	After intraocular surgeries, especially if healing is poor
Congenital anomalies	Some children are born with underdeveloped or malformed eyes (microphthalmos)

Table no. 1 Cause of ocular prosthesis

Management

- No treatment to restore vision
- Cosmetic rehabilitation:
 - Scleral shell prosthesis is often used to cover the shrunken eye for aesthetics improvement
 - If painful or cosmetically unacceptable, surgical removal (enucleation or evisceration) may be done, followed by fitting a full custom ocular prosthesis

Type	Material	Indications	Features	Advantages
Acrylic (PMMA) Custom Ocular Prosthesis	Polymethyl Methacrylate (PMMA)	General use after enucleation or evisceration	Hand-painted iris, custom fit, most commonly used	Lightweight, biocompatible, durable, good aesthetics
Scleral Shell Prosthesis	Thin PMMA	Phthisis bulbi, microphthalmia, or blind shrunken eye	Fits over the existing eye like a shell	Avoids surgery, retains residual ocular structure
Implant-Supported Prosthesis	PMMA, Hydroxyapatite, Silicone, Polyethylene	After enucleation/evisceration with orbital implant	Covers conjunctival surface over orbital implant	Better motility, more natural movement
Magnet-Retained Prosthesis	Acrylic + Magnet components	Severe socket contraction or orbital exenteration	Uses magnets for retention; often part of larger craniofacial prosthesis	Useful in complex facial defects
Digital Custom Ocular Prosthesis	PMMA with digital imaging	All prosthetic cases where high aesthetics demand exists	3D printing and digital imaging for iris/sclera	Enhanced precision, reproducibility, faster production

Table no. 2 Classification of Ocular Prosthesis

Custom ocular prostheses are designed using a variety of materials and techniques, tailored to the patient's clinical condition and cosmetic needs. The most commonly used type is the Acrylic (PMMA) custom ocular prosthesis, made from polymethyl methacrylate, which is hand-painted to match the patient's natural eye and offers advantages such as lightweight, durability, biocompatibility, and good aesthetics. For patients with a phthisical or microphthalmia eye, a scleral shell prosthesis made from thin PMMA is often used. This type fits over the existing eye like a shell and helps avoid surgical removal while maintaining the residual ocular structure. In cases where an orbital implant has been placed following enucleation or evisceration, an implant-supported prosthesis is used. These prostheses, made from materials like hydroxyapatite, silicone, or polyethylene, are designed to fit over the conjunctiva covering the implant and offer improved motility and more natural eye movement. For more complex cases, such

as those involving severe socket contraction or orbital exenteration, a magnet-retained prosthesis may be employed. These prostheses incorporate magnetic components for retention and are often integrated into larger craniofacial prosthetic designs. Lastly, digital custom ocular prostheses represent a modern advancement, using PMMA in combination with digital imaging and 3D printing technologies. This method allows for highly precise replication of the iris and sclera, improving esthetic outcomes and production efficiency. Each type serves a unique clinical purpose and reflects ongoing progress in ocular prosthetic technology. (Raizada K etc. 2010)

Protein Deposit

Ocular prostheses are in constant contact with the tear film, making them susceptible to surface deposits over time. Among the most common deposits are proteins and lipids, which originate from natural components of the tear film such as lysozyme, albumin, globulins, and secretions from the meibomian glands. These substances adhere to the surface of the prosthesis, especially when made from polymethyl methacrylate (PMMA), a material known for its microscopic porosity. Protein deposits often appear as cloudy or whitish films, while lipid deposits present as yellowish, greasy patches, both contributing to a roughened surface texture. If not managed properly, these deposits can lead to discomfort, increased ocular discharge, socket irritation, and reduced patient satisfaction. The extent of deposition is influenced by factors such as the tear film composition, hygiene practices, surface smoothness of the prosthesis, and the type of cleaning solution used. Therefore, regular cleaning, appropriate polishing, and the use of effective cleansing agents are essential to minimize deposit buildup and ensure long-term prosthetic eye comfort and function.

The Composition of deposit on contact lenses is likely to be similar to deposits include tear proteins, lipids (lipid deposit buildup may be both on the surface and inside the lens matrix) mucin, and contaminants, such as skin lipids, dirt, micro-organisms, and metallic and non-metallic debris. (Pine et al., 2013).

To demonstrate that the presence of surface deposit on prosthetic eyes is associated with less conjunctival inflammation and less severe mucoïd discharge in anophthalmia socket. There appears to be no literature describing deposit buildup on prosthetic eyes even though extensive literature describes deposit buildup on contact lens. Prosthetic eyes are somewhat analogous to contact lenses, but are made from different materials and worn for very different reasons both devices come into contact with conjunctival share a similar eyelid action are bathed in the same ocular fluids and accumulate surface deposits. These similarities relevant information from contact lens investigations provides a useful background for this study.

Aim of the study

The major aim of this study is to assess and compare the efficacy and durability of two alternative polishing solutions for maintaining the surface integrity and cleanliness of ocular prostheses.

Purpose of the study

- To assess the cleaning and polishing effectiveness of two different polishing solutions in eliminating lipid and protein deposits on ocular prostheses.
- To determine which method most effectively restores the prosthesis' surface quality to that of a new device, consequently improving user comfort and hygiene.
- To assess each polishing method's long-term capacity to retain prosthetic clarity while limiting deposit

development.

Objectives of the study

1. Compare the efficacy of two alternative polishing solutions in restoring the surface quality of used ocular prostheses by assessing their capacity to clean and polish the prosthetic surface to a state similar to that of a fresh ocular prosthesis.
2. To investigate the time-dependent accumulation of lipid deposits on ocular prosthesis during routine use, with the goal of determining the average duration required for clinically significant lipid build-up that may warrant cleaning or replacement.

REVIEW OF LITERATURE

The buildup of deposits on ocular prostheses has long been a problem in anophthalmia patients, causing discomfort, irritation, and mucoid discharge. Pine et al. (2012) addressed this issue by researching the various types, causes, and clinical implications of deposit deposition on prosthetic eyes.

Previous research has emphasized the difficulties of maintaining ocular prosthesis cleanliness. Deposits, primarily made of lipids, proteins, and mucin, develop on the prosthesis's surface over time, potentially causing inflammatory responses in the surrounding ocular tissue. However, there is little information on how the rate and content of these deposits affect patient symptoms and prosthetic care regimens (Pine et al., 2012).

Pine et al. (2012) addressed this gap by rigorously examining the surfaces of utilized ocular prostheses and linking deposit buildup to clinical complaints including discomfort and excessive mucoid discharge. Their findings indicated that surface roughness and imperfections accelerate the buildup of biological material, exacerbating socket inflammation. In addition, the study found that cleaning frequency and technique have a substantial impact on deposit formation (Pine et al., 2012).

Notably, the report underlined the lack of standardized cleaning protocols and polishing solutions, implying that more research into the best materials and methods for deposit reduction is required. It was noted that deposit accumulation period varies between individuals, depending on factors such as tear makeup, cleanliness behaviours, and prosthesis material (Pine et al., 2012).

Pine et al.'s (2012) findings support the concept that improving the surface finish and maintenance of ocular prostheses could minimize inflammation and discharge, hence improving patient comfort and prosthesis longevity. Their findings serve as a platform for future research into polishing materials and processes, and are closely aligned with the goals of present research into optimal cleaning solutions and deposit formation timelines.

The surface qualities of ocular prostheses have a significant impact on their performance and biocompatibility, particularly wettability and deposit resistance. In a 2013 study, Pine et al. investigated the relationship between deposit formation and surface wettability of prosthetic eye materials under controlled laboratory circumstances (Pine et al., 2013).

Previous investigations focused on clinical observations of deposit deposition on patient-worn ocular prostheses. However, they did not conduct controlled experiments to determine how material qualities affect deposition. This work addressed that gap by looking at how biological molecules interact with prosthetic surfaces in a controlled lab context, free of patient variability (Pine et al., 2013).

The authors investigated the changes in wettability, a critical measure of surface cleanliness and hydrophilicity, before and after exposure to simulated tear film deposits. They discovered that deposit

deposition considerably lowers surface wettability, making the prosthesis more susceptible to irritation, pain, and mucoid discharge in clinical situations. A decrease in wettability may also prevent the tear film from spreading evenly throughout the prosthesis, leading to dryness and increased friction within the ocular socket (Pine et al., 2013).

The study stressed that the type of prosthetic material and surface polish have a significant impact on how rapidly and broadly deposits accumulate. These findings contribute to the development of more modern materials and cleaning chemicals that can withstand surface deterioration and maintain good wettability throughout time (Pine et al., 2013).

This study provides a scientific basis for understanding how cleaning agents and polishing solutions should be designed to maintain surface quality and extend prosthesis usability. It's *in vitro* model also serves as a basis for future comparative studies of cleaning agents and surface treatments (Pine et al., 2013).

The accumulation of protein deposits on ocular prostheses is a significant clinical concern due to its impact on comfort, appearance, and ocular health. These deposits, primarily derived from tear film proteins such as lysozyme, albumin, and lactoferrin, can adhere to prosthetic surfaces over time, particularly if surface roughness is present or hygiene is inadequate. Multiple studies have examined the mechanisms and contributing factors to deposit buildup, as well as strategies for prevention.

3. Raizada and Rani (2010) provided a comprehensive overview of ocular prosthesis fabrication and maintenance. Their review emphasized the biocompatibility of PMMA (Polymethyl methacrylate), the most commonly used material for custom ocular prostheses, but noted its susceptibility to protein and lipid deposition over time. They highlighted the importance of regular maintenance—including surface polishing and hygienic handling—to prevent the accumulation of organic material, which may otherwise lead to chronic discharge, discomfort, and microbial colonization (Raizada & Rani, 2010).

4. In a clinical study on prosthetic eye users, Parida's and van den Bosch (1998) found a direct correlation between poor cleaning habits and increased protein and microbial deposits. Patients who cleaned their prostheses infrequently exhibited a higher rate of surface contamination, particularly on the posterior concave side, where tear proteins tend to accumulate. Microbiological analysis revealed colonization by Gram-positive and Gram-negative organisms, underlining the need for regular disinfection and polishing to maintain prosthetic hygiene (Parida's & van den Bosch, 1998).

Although primarily focused on contact lenses, the work of Abdi et al. (2003) supports the relevance of surface cleaning in ocular prosthetics. Their study investigated tear film deposition on lens surfaces and the effectiveness of various cleaning regimens. They demonstrated that protein deposits form readily on polymer-based ocular surfaces and that consistent use of enzymatic cleaners and polishing agents significantly reduced deposition. These findings reinforce the importance of rigorous maintenance protocols for ocular prostheses to mitigate protein accumulation and associated complications (Abdi et al., 2003).

Together, these studies underscore the multifactorial nature of protein deposit buildup and highlight the role of material choice, surface finish, and user hygiene in determining prosthesis longevity and comfort. They also establish a scientific basis for recommending specific polishing protocols, including the use of fine abrasives and professional cleaning agents, to maintain an optimal ocular environment

Research Gap

While previous studies attempted to standardize polishing protocols by adapting optical contact lens

quality standards, there is a scarcity of research that specifically evaluates the types of polishing materials used and their effectiveness in reducing lipid and protein deposits on ocular prostheses. There is currently no solid evidence about the timeframe in which lipid and protein deposits develop to clinically relevant quantities on the surface of ocular prostheses.

METHODOLOGY

Methodology

Study population: 46 patients

Study design: Cross sectional observational study

Study setting: Single-centered

Study duration: 10 Months

Sample size calculation:

$$n = \left\{ \left\{ Z_{1-\frac{\alpha}{2}}^2 \cdot SD^2 \right\} \right\} \{d^2\}$$

Where, for

Z= 1.96

SD = 1.5

d = 5 % error

To convert 5% to a decimal

= 46 patients

Sampling technique: Non -probability purposive sampling technique

Inclusion Criteria:

- Participants have to be at least 18 years old.
- Must have worn an ocular prosthesis for at least six months.
- There are no current infections or inflammations in the eyes or periocular area.

Exclusion Criteria:

- Bilateral prosthetic users.
- A history of allergic reactions to polishing recleaning products.
- Patients with systemic medical conditions that affect tear composition (like Sjögren's syndrome).

Materials:

- Two commercially available polishing solutions (Solutions A Johnson Baby shampoo and Solutions B Pro-master cleaning solution).
- Standard plaque disclosing gel (5 g in 30 mL 0.85% saline).
- A high-resolution digital camera with standardized settings.
- Microsoft PowerPoint-based grading scale (0–10).
- Wet calico polishing mop, felt cone, aluminium oxide paste, and polishing solutions.

Methodology:**Study Design**

This study is a prospective, comparative, interventional study aimed at evaluating and comparing the effectiveness of two commercially available polishing solutions—Solution A (Johnson's Baby Shampoo) and Solution B (Pro-Master Cleaning Solution)—in reducing surface deposits and maintaining the clarity and surface quality of ocular prostheses.

Study Setting and Participants

The study will be conducted at a clinical ocular prosthetics center and will involve 46 participants with unilateral ocular prostheses who have been wearing their prosthesis for at least six months. Informed consent will be obtained from all participants prior to inclusion

Polishing artificial eyes.

This study's procedure for polishing prosthetic eyes consisted of four steps. First, the prosthesis was trimmed, and all surfaces were ground with a fine (120 grit) Arbor band. Second, Diatomaceous earth was applied to the surfaces using a wet calico polishing cloth and/or a felt cone to erase the Arbor band marks. Third, a dry calico polishing mop was used to apply the final polishing compound for plastics (Bego, Lincoln, RI6). The Bego product is no longer in production, however it is comparable to other commercially available denture polishing compounds. Fourth, an optical quality contact lens polishing standard was produced by applying aluminium oxide paste with a foam polyurethane rotating cone (Murthy et al., 2015; Beumer et al., 1996).

Polishing Procedure

A small quantity of standard plaque disclosing gel (5 g in 30 mL 0.85% saline) was applied uniformly over the prosthetic surface. This highlighted proteinaceous and organic deposits through visible staining. (Ammons WF, Scheirton LS, Delaney JE 1973)

3. Pre-polishing Image Capture

The stained prosthesis was photographed using a high-resolution digital camera with standardized lighting, angle, and background settings. This allowed documentation of pre-cleaning deposit levels for comparison.

Depending on the group, Solution A or Solution B was used during polishing:

- Solution A: Johnson's Baby Shampoo (used as a mild, soapy lubricant)
- Solution B: Pro-Master Cleaning Solution (used as a specialized cleaner)

Each sample was polished under the same speed, time, and pressure conditions. After polishing, the prosthesis was thoroughly rinsed with sterile saline to remove all polishing residue, paste, and solution. It was then gently dried with a lint-free sterile cloth. Post-polishing, the disclosing gel was reapplied and another standardized image was taken using the same camera setup. Both pre- and post-polishing images were inserted into a Microsoft PowerPoint-based grading template (0–10 scale). Three masked observers independently graded the level of visible deposits.

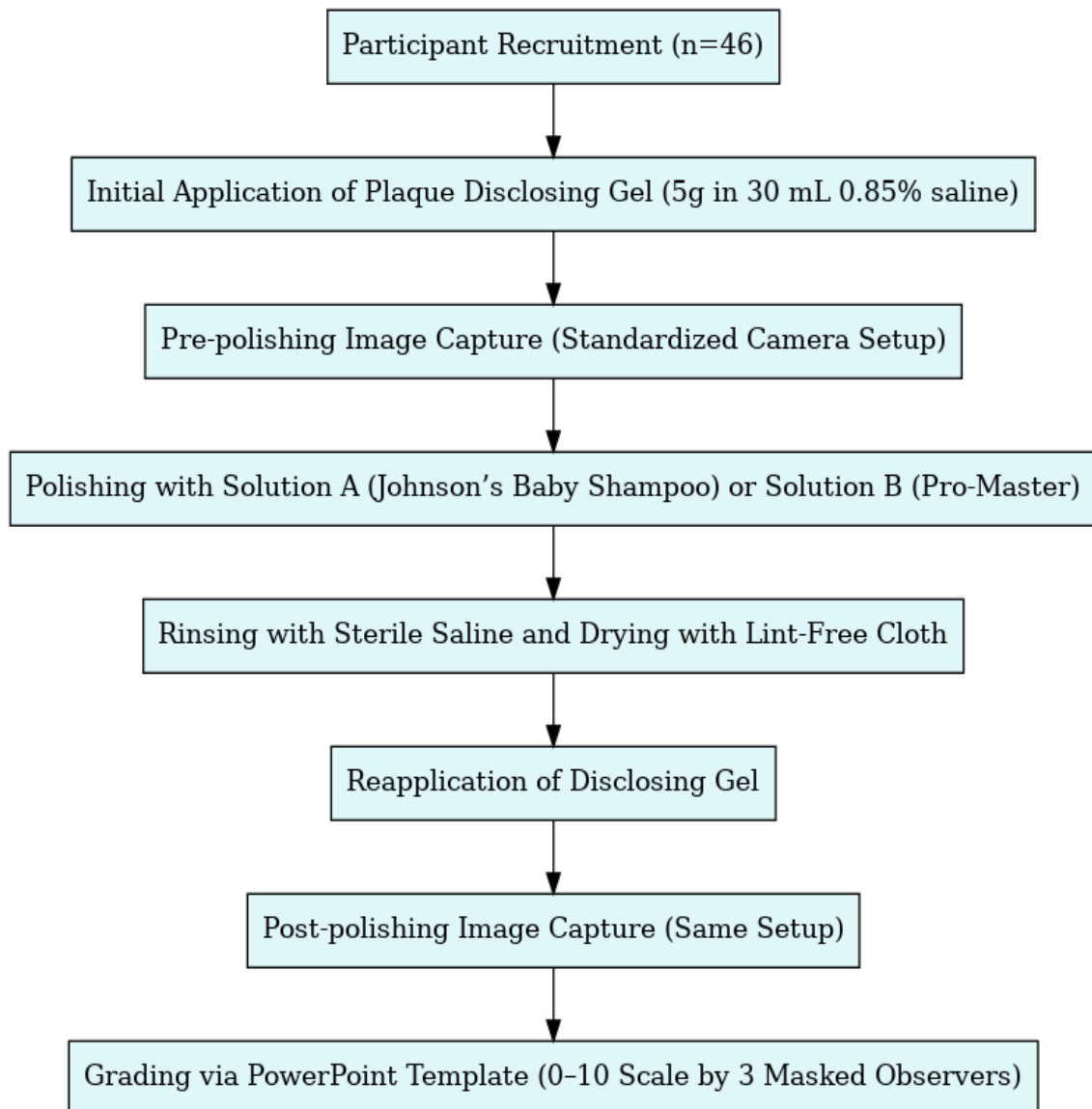


Figure no. 3 Study Methodology Flowchart

Two techniques are used to evaluate deposit accumulation on polished prosthetic eyes.

For this comparative investigation, 46 subjects wearing unilateral prosthetic eyes were enlisted. The efficiency of two polishing methods—Johnson's Baby Shampoo Polish and Pro-Master Cleaning Solution Standard—in reducing the accumulation of surface deposits during continuous wear for one month was to be assessed.

23 participants used Johnson's Baby Shampoo Polish Standard to polish their eye prostheses at baseline. After being reinserted into the eye sockets, the polished prostheses were worn continuously for one month without cleaning or removal. Using a previously published Surface Buildup Photography Scale (rated from 0 to 10), which assesses the degree and severity of surface deposits on both anterior and posterior surfaces, the prostheses were carefully removed at the end of the month and put through deposition grading.

The next 23 participants used the Pro-Master Cleaning Solution Standard procedure to polish their eye prostheses. After polishing, they were re-inserted and worn continuously under the same conditions for one month. After this one-month period, the prostheses were taken out and graded for the number of

deposits that had accumulated on the surface using the same standard procedure.

RESULTS

A total of 46 participants with unilateral ocular prostheses were included in the study. Each prosthesis was randomly assigned to be polished with either Solution A (Johnson’s Baby Shampoo) or Solution B (Pro-Master Cleaning Solution). Surface protein deposits were assessed before and after polishing using a standardized plaque disclosing gel and graded on a 0–10 visual scale by three independent masked observers.

1. Deposit Grading Results

After 1 month of wear and cleaning, the mean protein deposit score was:

- Solution A (Johnson’s Baby Shampoo): 3.092 ± 0.26
- Solution B (Pro-Master Solution): 1.25 ± 0.59

A paired-sample t-test revealed that the difference in scores was statistically significant ($p < 0.05$), indicating that Pro-Master Solution was more effective in reducing visible protein deposits on the prosthetic surface. The test compared the mean scores of post-cleaning deposit levels between the two groups, each consisting of 23 ocular prostheses.

The results showed a t-value of 13.60, with an associated p-value of less than 0.00001. Given that the p-value is significantly lower than the conventional alpha level of 0.05, the difference between the two groups is considered statistically significant. This implies that the observed difference in mean deposit scores is unlikely to have occurred by chance.

The pooled variance was calculated as 0.21, and the variance of the mean for each group was 0.01, based on a sample size of 23 in each group. The observed mean difference between the two groups (1.84 units on a 0–10 grading scale) yielded a t-score far above the critical threshold, indicating a large effect size and a strong difference in cleaning performance between the two polishing solutions.

Therefore, it can be concluded that Solution B (Pro-Master Cleaning Solution) demonstrated significantly higher efficacy in reducing protein deposits on ocular prostheses compared to Solution A (Johnson’s Baby Shampoo). These findings support the use of specialized prosthetic cleaning agents for improved hygiene and patient comfort.

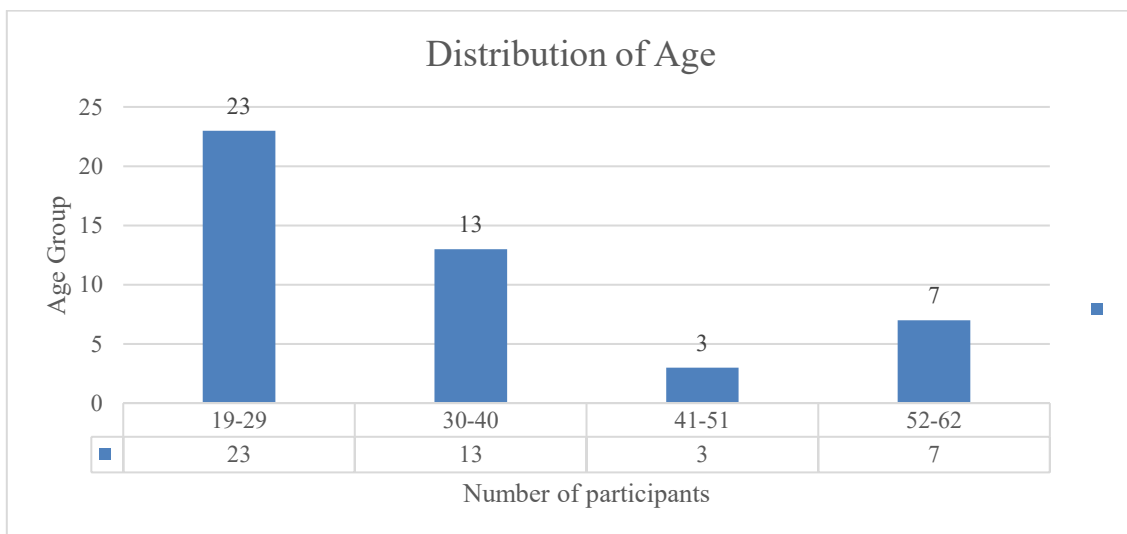


Fig no 4. "Age Distribution of Participants with Ocular Prostheses"

Note: The age distribution indicates that most participants fall within the 19–29 age group (50%), followed

by 30–40 (28%). “The participant pool was skewed towards younger individuals, with 23 participants (50%) in the 19–29 age group. The next most common group was 30–40 years (28%), followed by smaller representations in the 52–62 (7 participants) and 41–51 (3 participants) ranges.”

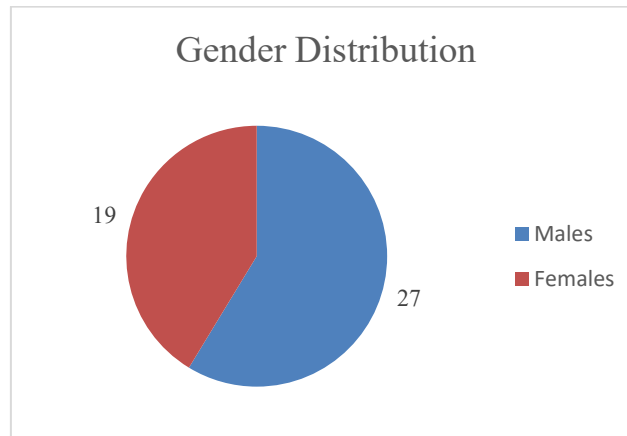
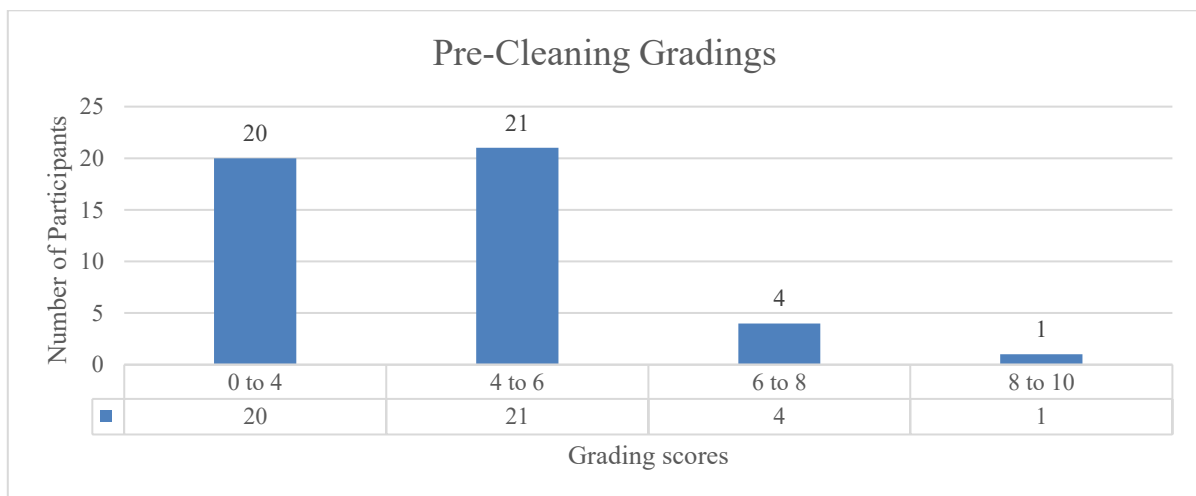


Figure no 5. "Gender Distribution of Study Participants"

“Out of the 46 participants in the study, 27 were male (58.7%) and 19 were female (41.3%). The gender distribution shows a moderate male predominance.” Gender was recorded at the time of patient intake. Distribution reflects the demographic profile of prosthesis users in the study sample.



Graph no 6. “Distribution of Pre-Cleaning Protein Deposit Scores on Ocular Prostheses”

Note: Grading scores reflect observer-based assessments of visible proteinaceous deposit levels on stained ocular prostheses prior to polishing (Scale: 0 = no deposits, 10 = heavy deposits). The majority of pre-cleaning deposit ratings for the 46 prosthetic eyes that were assessed fell into the middle range. Particularly, 21 prosthesis had scores between 5.9 and 6.9, and 20 prostheses received scores between 4.8 and 5.8. Four of the patients had deposit levels between 7.0 and 8.0, and only one prosthesis scored more than 8.0.

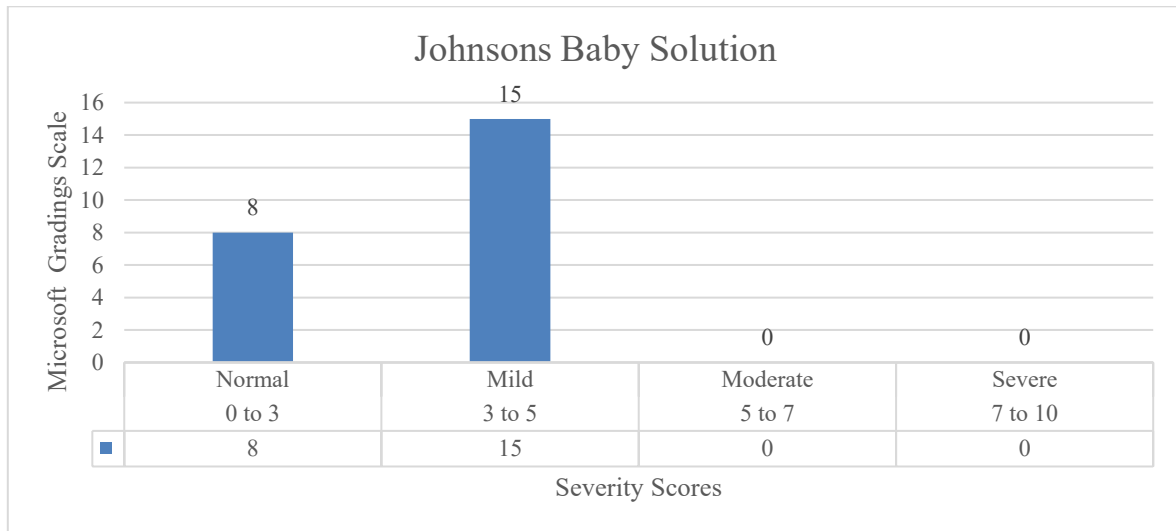


Fig no 7.1 “Workflow of Prosthesis Polishing with Johnson Baby shampoo and Grading Procedure”

The majority of prostheses cleaned using Johnson’s Baby Shampoo fell into the “Mild” severity category (15 out of 23 participants). A smaller number (8 participants) were graded as “Normal”, indicating relatively lower levels of surface deposit build-up. no cases of “Moderate” or “Severe” buildup were observed with this cleaning method.

The Microsoft Grading Scale showed that Johnson's Baby Shampoo caused low to mild protein deposit buildup on ocular prostheses, with no indication of serious or severe deposition. Even though it's not ideal, it's safe enough to avoid causing high-grade surface accumulation.

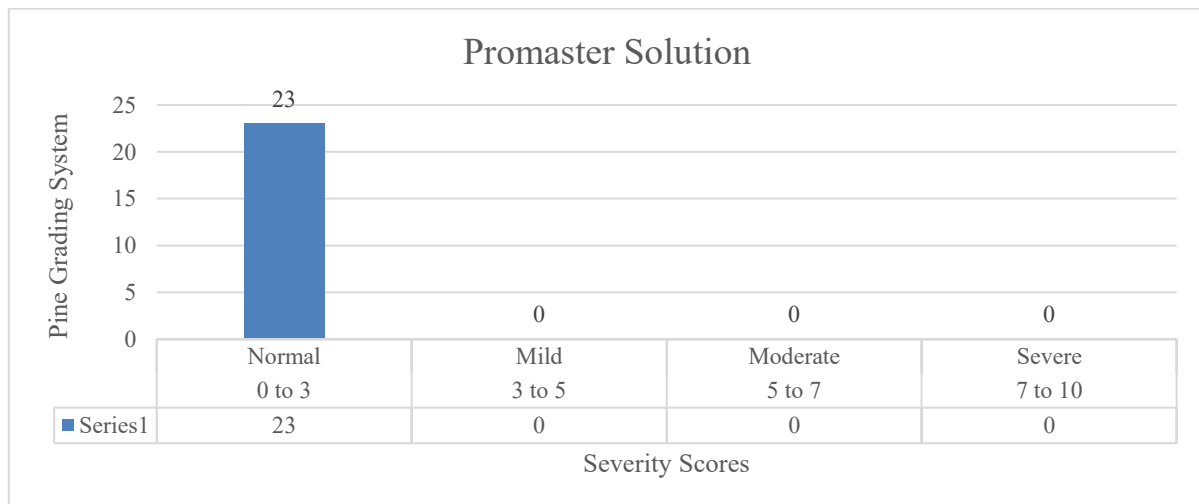


Fig no 7.2. “Workflow of Prosthesis Polishing with Pro- Master Solution and Grading Procedure”

All 23 participants whose ocular prostheses were cleaned with Pro-Master Solution fell under the "Normal" severity range. There were no cases of mild, moderate, or severe protein deposit buildup.

Pro-Master Solution proved to be extremely successful at preventing the buildup of protein deposits on eye prosthesis. When compared to Johnson's Baby Shampoo, all prostheses cleansed with this solution maintained the lowest severity score, demonstrating superior cleaning and polishing capabilities.

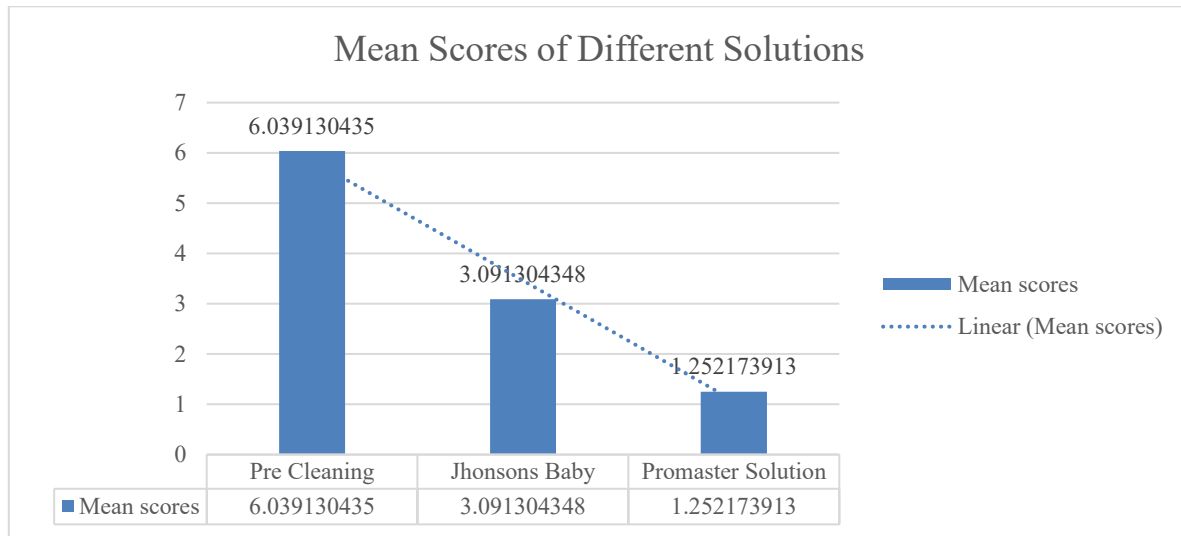


Figure no 8. Mean Scores of Different Solutions

High protein and debris levels before cleaning are indicated by a pre-cleaning score of 6.04. When assessing cleaning efficacy, this score serves as the standard reference.

Johnson's Baby Shampoo (version 3.09): Almost completely eliminates the intensity of deposits. Nevertheless, a moderate amount of protein remains present even after cleaning, suggesting that it is only partially successful and is not the best choice for long-term hygiene.

Pro-Master Solution (1.25): With a significant reduction in surface deposits, the intensity is brought down to almost normal levels. This solution is the most effective among the compared solutions due to its excellent cleaning efficacy.

DISCUSSION

This study investigated the efficacy of two different cleaning solutions, Johnson's Baby Shampoo (Solution A) and Pro-Master Cleaning Solution (Solution B), in reducing protein deposits on ocular prostheses. The findings clearly demonstrate that Pro-Master Cleaning Solution significantly outperforms Johnson's Baby Shampoo in maintaining the cleanliness of prosthetic eye surfaces.

The accumulation of protein and other deposits on ocular prostheses is a well-documented issue, contributing to patient discomfort and potential complications (Pine et al., 2012; Pine et al., 2013). Our findings corroborate the existing literature by underscoring the necessity of effective cleaning regimens. are consistent with the general understanding of deposit buildup on prosthetic surfaces over time (Pine et al., 2012). These deposits, as highlighted by Brown and Jones (2010) in the context of contact lenses, can lead to reduced wettability and increased friction, impacting patient comfort and potentially fostering microbial growth.

While Johnson's Baby Shampoo is often used as a gentle cleanser in various ophthalmic contexts, its performance in this study suggests it is only partially effective for the rigorous demands of ocular prosthesis hygiene. The residual protein levels, even after cleaning with Solution A, indicate that it may not be sufficient for long-term optimal hygiene. This aligns with the understanding that specialized solutions are often required to effectively manage biofilm and protein accumulation on biomaterials, as seen in the broader context of contact lens care (Brown & Jones, 2010).

In contrast, the superior performance of Pro-Master Cleaning Solution aligns with the need for specialized

cleaning agents designed to tackle the specific challenges of prosthetic eye maintenance. The significant reduction in protein deposits achieved by Pro-Master Solution underscores its potential for improved hygiene, which in turn can contribute to better patient comfort and reduced incidence of complications such as conjunctival inflammation and mucoid discharge, as discussed by Pine et al. (2012). The ability of Pro-Master Solution to consistently bring deposit levels to a "Normal" range indicates its strong cleaning and polishing capabilities, effectively preventing high-grade surface accumulation.

The demographic data collected for this study revealed a participant pool skewed towards younger individuals, this age distribution, coupled with a moderate male predominance provides valuable insights into the demographic profile of ocular prosthesis users in the studied population. While this demographic information does not directly influence the efficacy of the cleaning solutions, it offers context for the applicability of these findings within specific patient populations. Future studies could explore if age or gender influences cleaning habits or the rate of deposit accumulation, although such an investigation was beyond the scope of this study.

The methodology employed in this study, including the use of a standardized plaque disclosing gel and masked observers for deposit grading, enhanced the objectivity and reliability of the results. The comparison to previous studies on deposit buildup and cleaning habits (Paridaens & van den Bosch, 1998; Pine et al., 2013) further contextualizes our findings within the existing body of knowledge regarding ocular prosthesis care. The findings support the notion that rigorous cleaning protocols are crucial for maintaining the long-term health and comfort of individuals with ocular prostheses (Raizada & Rani, 2010).

In conclusion, this study provides strong evidence that Pro-Master Cleaning Solution is significantly more effective than Johnson's Baby Shampoo in reducing protein deposits on ocular prostheses. These findings advocate for the routine use of specialized cleaning solutions for individuals wearing ocular prostheses to ensure optimal hygiene, enhance patient comfort, and potentially mitigate associated complications. Further research could explore the long-term effects of Pro-Master Solution on prosthesis longevity and patient quality of life.

CONCLUSION

Overall, this study supports the clinical recommendation of Pro-Master Cleaning Solution as a superior alternative to general-purpose cleansers such as Johnson's Baby Shampoo. Future research should expand on these findings by incorporating broader metrics such as lipid removal, patient satisfaction, and long-term prosthesis preservation to guide best practices in ocular prosthetic care.

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