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Original Article

Efficacy of Povidone-Iodine in Reducing Pain and Swelling After Lower Third Molar Surgery: A Randomized Controlled Trial

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Abstract

Background: Postoperative pain and swelling are common complications after mandibular third molar extraction. Povidone-iodine, due to its antimicrobial and anti-inflammatory properties, may help reduce these symptoms.

Objective: To compare the efficacy of povidone-iodine and normal saline irrigation in minimizing postoperative pain and swelling following surgical removal of impacted lower third molars.

Methodology: This randomized controlled trial included 90 patients aged 18–45 years, divided equally into two groups: Group A received 0.5% povidone-iodine irrigation, and Group B received 0.9% sterile normal saline. Pain and swelling were assessed on postoperative Days 1, 3, and 7 using the Wong-Baker Faces Pain Rating Scale and linear facial measurements. Data were analyzed using SPSS v22, with repeated measures ANOVA and Chi-square tests ($p<0.05$ considered significant).

Results: Among 90 participants, 42 (46.7%) were male and 48 (53.3%) female. Both groups showed significant reduction in mean pain and swelling from Day 1 to Day 7 ($p<0.001$). Povidone-iodine showed slightly better early outcomes, but the overall difference between groups was statistically non-significant.

Conclusion: Both povidone-iodine and normal saline effectively reduced postoperative pain and swelling. Povidone-iodine offered minor early benefits and may be used as a safe, low-cost alternative for third molar surgery.

Keywords: Irrigation, Mandibular third molar, Povidone-iodine, Postoperative pain, Swelling.

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Introduction

The mandibular third molar is the most frequently impacted tooth due to various etiological factors, including inadequate retromolar space, abnormal eruption path, genetic predisposition, and phylogenetic reduction in jaw size [1]. Typically, third molars erupt between 18 and 24 years of age [2]. Surgical extraction of impacted mandibular third molars is one of the most commonly performed oral surgical procedures. However, postoperative complications such as pain, swelling, trismus, alveolar osteitis, and wound infection are frequent and can significantly affect patients' quality of life [3].

Various techniques and materials have been investigated to minimize these postoperative sequelae [4,5]. Topical antiseptic agents are commonly used to reduce bacterial contamination and promote wound healing [6]. Among these, iodine-based compounds have long been employed as effective antiseptics in surgical and clinical practice due to their broad-spectrum antimicrobial activity [7].

Povidone-iodine (PVP-I) is a stable complex formed by binding elemental iodine to the carrier polymer polyvinylpyrrolidone (PVP), a modification introduced by Shelanski and Shelanki in 1956 to enhance safety and reduce the irritant effects of free iodine [9]. The compound acts through multiple mechanisms, including protein denaturation, oxidation of sulfhydryl groups, and interference with hydrogen bonding in amino acids and nucleic acids [10]. Owing to these properties, povidone-iodine is widely used in dental and surgical procedures for irrigation and disinfection of wounds.

In oral surgery, povidone-iodine is considered an effective irrigant for extraction sockets, combining antimicrobial activity with potential anti-edematous and anti-inflammatory effects [11,12]. It has been reported to suppress inflammatory mediators such as histamine, bradykinin, serotonin, and prostaglandins, thereby reducing postoperative tissue edema and pain [12].

Given the significant morbidity associated with third molar surgeries and the limited evidence from local studies, this research was designed to evaluate whether postoperative irrigation with low-concentration povidone-iodine can reduce pain and swelling compared with conventional saline irrigation following mandibular third molar extraction.

Methodology

Study Design:

This study was designed as a randomized controlled trial conducted to assess the efficacy of povidone-iodine irrigation in reducing postoperative pain and swelling following the surgical extraction of impacted lower third molars. The trial followed the CONSORT guidelines to ensure methodological rigor and transparency in participant enrollment, allocation, and analysis.

Ethics:

Ethical approval for this study was obtained from the Research Ethics Committee of Liaquat University of Medical and Health Sciences (Approval No. LUMHS/REC:126, dated July 7, 2021). Written informed consent was obtained from all participants prior to inclusion, and the study was conducted in accordance with the Declaration of Helsinki ethical principles.

Setting:

The study was carried out at the Department of Oral and Maxillofacial Surgery, Liaquat University of Medical and Health Sciences, Jamshoro, Sindh, Pakistan, from August 1, 2021, to July 31, 2022. All procedures were performed in a controlled clinical environment under aseptic conditions.

Participants:

A total of 90 patients aged between 18 and 45 years requiring surgical extraction of mesioangularly impacted mandibular third molars were recruited using a non-probability convenience sampling technique. Patients with periapical infections, pericoronitis, or lesions related to impacted teeth; those on anticoagulant or long-term NSAID therapy; or with known iodine hypersensitivity were excluded from the study. Eligible participants were randomized into two equal groups (n=45 each) — Group A received povidone-iodine irrigation, while Group B received sterile normal saline irrigation.

Variables:

The main outcome variables were postoperative pain and facial swelling. Secondary observations included hemostasis and wound healing. Pain was evaluated using the Wong-Baker Faces Pain Rating Scale, while swelling was quantified by measuring the linear distance from the mandibular angle to the menton in millimeters. Additional demographic variables such as age and gender were also recorded.

Data Sources/Measurement:

Preoperative evaluation included clinical examination, orthopantomogram (OPG), and periapical radiographs to

confirm impaction type. All extractions were performed by experienced surgeons under local anesthesia using standardized aseptic protocols. After tooth removal, Group A sockets were irrigated with 2 ml of 0.5% povidone-iodine solution, and Group B sockets were irrigated with 2 ml of 0.9% sterile normal saline (Ostaka, Pakistan). The surgical sites were sutured using Vicryl 3-0. Patients were recalled on postoperative Days 1, 3, and 7 for evaluation of pain, edema, and bleeding control.

Bias:

To minimize bias, all surgeries were performed by the same surgical team using standardized instruments and procedures. The evaluator assessing postoperative outcomes was blinded to the group allocation. Randomization ensured an equal distribution of potential confounders between groups.

Study Size:

The sample size was calculated using the Epitool online calculator based on parameters from a previous study by Sabe-Alarab et al. (2019), yielding a total of 90 participants to achieve a power of 80% and a 95% confidence level for detecting meaningful differences between interventions.

Quantitative Variables:

Continuous variables such as age, pain scores, and swelling measurements were expressed as mean ± standard deviation. Categorical variables such as gender and oozing duration were presented as frequencies and percentages.

Statistical Methods:

Data were analyzed using SPSS version 22.0. Descriptive statistics were calculated for all variables. Repeated measures ANOVA with Greenhouse-Geisser correction was applied to compare mean postoperative pain and swelling across time points (Days 1, 3, and 7) within and between groups. In cases of non-parametric distribution, the Friedman test was employed. A p-value of <0.05 was considered statistically significant.

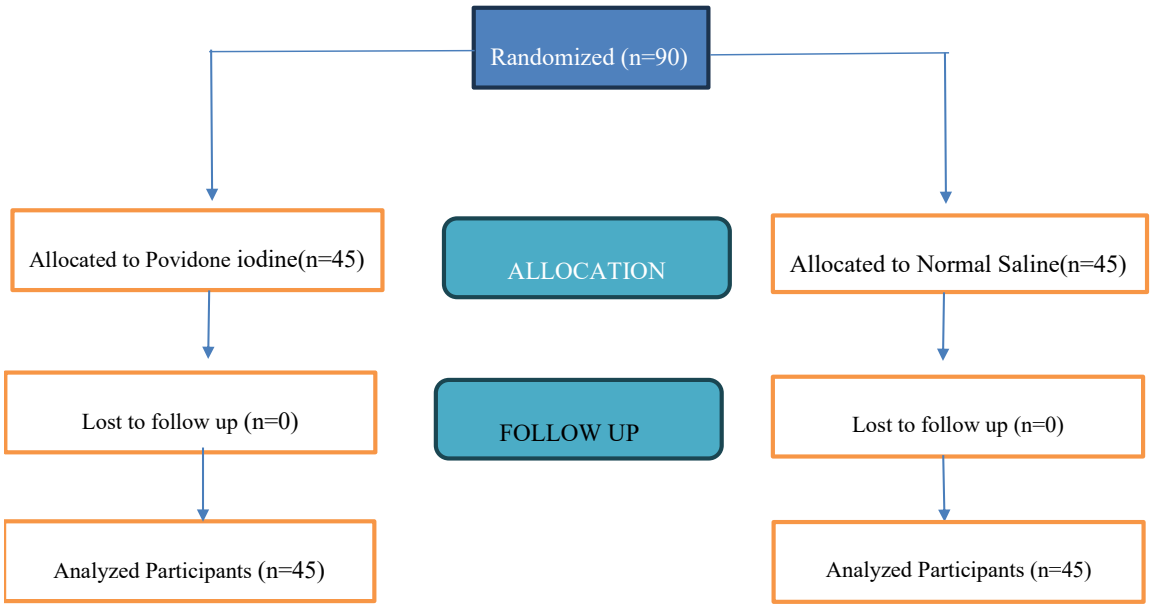


Figure 1: CONSORT flow diagram

Results

Participants

A total of 90 participants fulfilling the inclusion criteria were enrolled in the study and successfully completed all follow-up assessments, with no cases lost to follow-up. Among these, 42 (46.7%) were male and 48 (53.3%) were female, indicating a nearly equal gender distribution. The participants were divided equally into two groups: Group A, which received 0.5% povidone-iodine irrigation, and Group B, which received 0.9% sterile normal saline irrigation following the surgical extraction of impacted mandibular third molars. Randomization ensured a balanced allocation and comparable baseline characteristics between the two groups.

Descriptive Data

The mean age of participants in Group A (Povidone-Iodine Group) was 32.04 ± 7.13 years (range 18–42), while in Group B (Normal Saline Group) it was 30.02 ± 7.98 years (range 18–42). The age distribution revealed that the majority of the participants were in the 18–25 and 36–42-year age categories, reflecting the typical demographic profile of patients undergoing third molar extractions. Baseline comparison between groups using one-way ANOVA indicated no statistically significant difference in mean age ($p = 0.208$), confirming homogeneity between the study groups prior to intervention.

Outcome Data

The clinical outcomes assessed postoperatively included swelling, pain intensity, and hemostasis at three follow-up intervals—Day 1, Day 3, and Day 7. Swelling was classified as mild, moderate, or severe based on linear measurements (in mm) from the mandibular angle to the menton. On Day 1, moderate swelling was predominant in both groups (62.2% in Group A and 57.8% in Group B), whereas severe swelling was noted in 26.7% of Group A and 33.3% of Group B participants. By Day 3, swelling had notably decreased, with 64.4% of Group A and 53.3% of Group B patients showing only moderate swelling, and by Day 7, most participants in both groups demonstrated mild or no swelling ($p = 0.256$).

Postoperative pain was evaluated using the Wong-Baker Faces Pain Rating Scale. On Day 1, the majority of patients in both groups reported moderate to severe pain (55.6%–33.3% in Group A vs. 55.6%–33.3% in Group B). By Day 3, a noticeable reduction in pain was observed, with 60.0% of patients in Group A and 53.3% in Group B reporting only mild to moderate discomfort. By Day 7, 33.3% of Group A and 40.0% of Group B patients were pain-free, and the remaining majority experienced only slight discomfort. These findings demonstrate a progressive decline in pain scores over time in both groups.

Hemostasis was achieved within 24 hours in 37 (82.2%) participants in Group A and 38 (84.4%) in Group B, while minor oozing persisted up to 48 hours in a small proportion of cases (17.8% and 15.6%, respectively). The difference between the two groups was statistically non-significant ($p = 0.777$), indicating comparable outcomes in terms of wound bleeding control.

Main Results

Both povidone-iodine and normal saline irrigation groups demonstrated significant postoperative improvement in pain and swelling over time. Repeated measures ANOVA with Greenhouse-Geisser correction revealed a statistically significant reduction in mean edema and discomfort across Days 1, 3, and 7 ($p < 0.001$), although intergroup comparison showed no substantial difference between the two interventions. Post hoc Bonferroni analysis confirmed that the reduction in both pain and swelling was most pronounced between Day 1 and Day 3, and continued progressively through Day 7. While the mean swelling and pain scores were marginally lower in the povidone-iodine group on all follow-up days, these differences did not reach statistical significance.

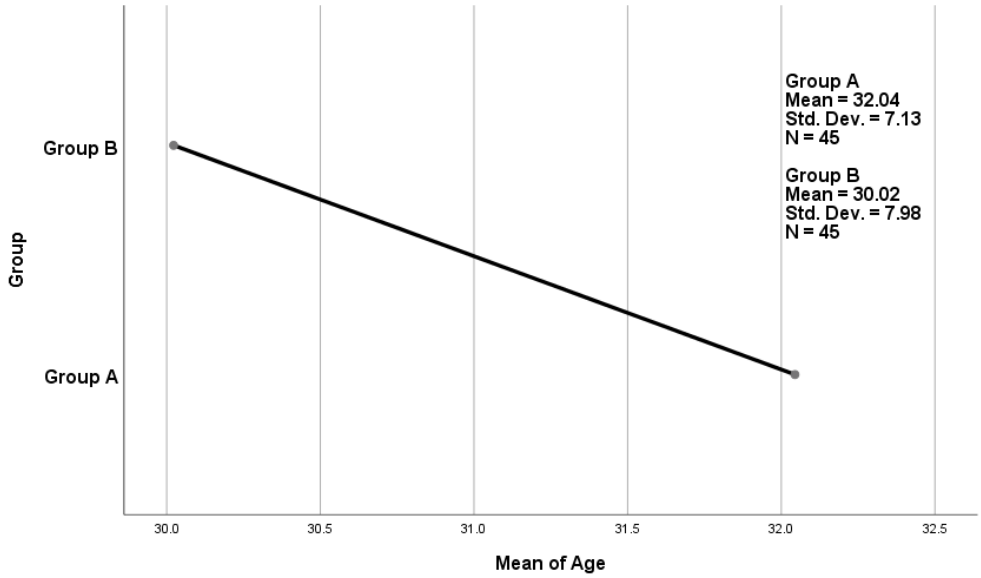
Irrigation with povidone-iodine produced slightly better early postoperative outcomes compared to normal saline, particularly during the initial 48 hours following surgery. However, by Day 7, both groups exhibited comparable recovery patterns, suggesting that while povidone-iodine may offer transient advantages in reducing acute postoperative inflammation, its long-term efficacy in minimizing pain and edema is similar to that of normal saline.

Table: 1. Distribution of Patients Depending on Postoperative Swelling at Days 1, 3, and 7

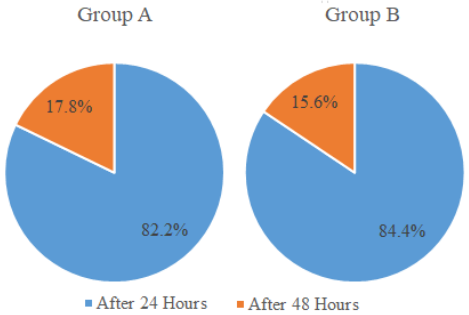
Day	Swelling	Group A	Group B	P-Value
DAY 1	Mild	5 (11.1%)	4 (8.9%)	0.772
	Moderate	28 (62.2%)	26 (57.8%)	
	Severe	12 (26.7%)	15 (33.3%)	
DAY 3	Absent	2 (4.4%)	2 (4.4%)	0.578
	Mild	14 (31.1%)	18 (40.0%)	
	Moderate	29 (64.4%)	24 (53.3%)	
	Severe	0 (0.0%)	1 (2.2%)	
DAY 7	Absent	15 (33.3%)	18 (40.0%)	0.256
	Mild	30 (66.7%)	25 (55.6%)	
	Moderate	0 (0.0%)	2 (4.4%)	

Table: 2. Patient Distribution on Day 1, Day 3, and Day 7 Based on Postoperative Pain

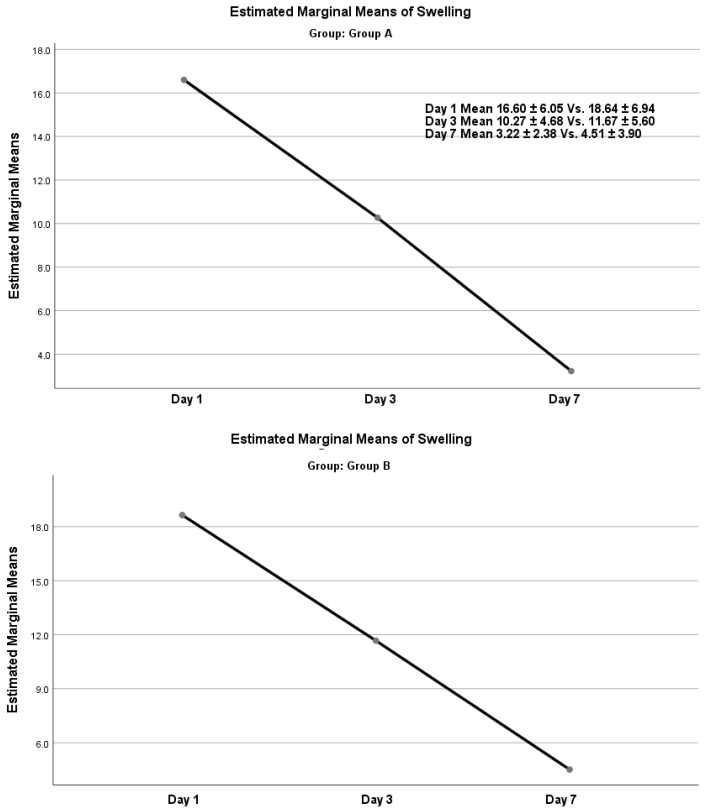
DAY	Swelling	Group A	Group B	P-Value
DAY 1	Hurts Little Bit	1 (2.2%)	1 (2.2%)	0.765
	Hurts Little More	7 (15.6%)	4 (8.9%)	
	Hurts Even More	25 (55.6%)	25 (55.6%)	
	Hurts Worst	12 (26.7%)	15 (33.3%)	
DAY 3	No Hurt	2 (4.4%)	2 (4.4%)	0.856
	Hurts Little Bit	4 (8.9%)	4 (8.9%)	
	Hurts Little More	12 (26.7%)	14 (31.1%)	
	Hurts Even More	27 (60.0%)	24 (53.3%)	
	Hurts Worst	0 (0.0%)	1 (2.2%)	
DAY 7	No Hurt	15 (33.3%)	18 (40.0%)	0.119
	Hurts Little Bit	24 (53.3%)	24 (53.3%)	
	Hurts Little More	6 (13.3%)	1 (2.2%)	
	Hurts Even More	0 (0.0%)	2 (4.4%)	



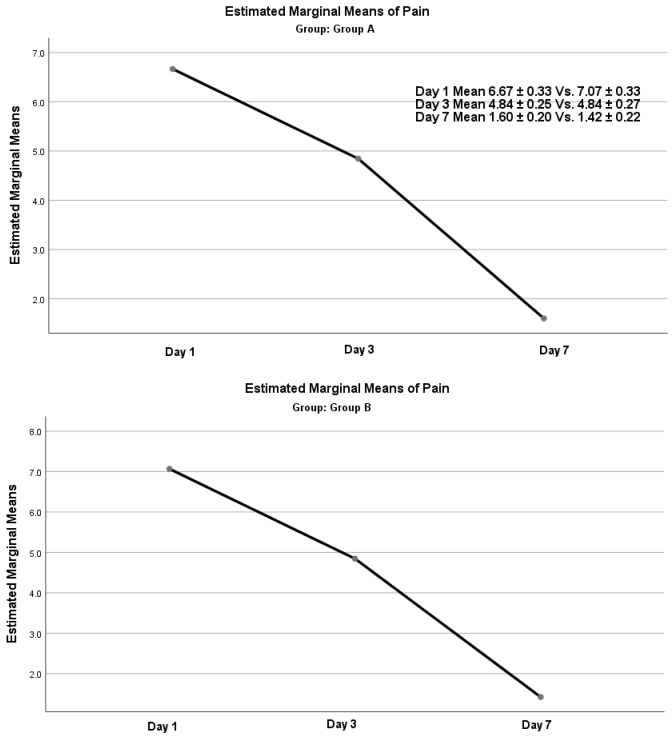
Graph 1: Descriptive Statistics of Age



Graph 2: Patients Distribution According to Hemostypic (Oozing Stopped)



Graph 3: One Way Repeated Measure ANOVA Test For Swelling



Graph 4: One Way Repeated Measure ANOVA Test For Pain

Discussion

The present randomized controlled trial evaluated the efficacy of povidone-iodine irrigation compared with sterile normal saline in minimizing postoperative pain and swelling following the surgical extraction of impacted mandibular third molars. The findings indicated that while both irrigation solutions significantly reduced pain and edema over time, povidone-iodine demonstrated slightly better outcomes during the early postoperative period, although the difference between groups was not statistically significant.

In the current study, the mean age of participants was 32.04 ± 7.13 years in the povidone-iodine group and 30.02 ± 7.98 years in the saline group, consistent with earlier reports indicating that third molar impaction and associated complications are more prevalent in young adults aged 18–35 years [1,2]. The demographic similarity between the two groups ensured that age-related physiological variations did not confound the postoperative healing outcomes.

The reduction in postoperative swelling observed in both groups between Days 1 and 7 aligns with previous studies demonstrating that surgical trauma-induced inflammatory response peaks within the first 48 hours and gradually subsides thereafter [5,11]. Povidone-iodine irrigation appeared to slightly reduce facial edema compared with normal saline during the early postoperative days, consistent with findings reported by Hashemi et al. [5] and Arakeri and Brennan [14], who attributed this effect to the compound's ability to modulate inflammatory mediators such as histamine, bradykinin, and prostaglandins. However, similar to the results of Sruthy et al. [13], the difference between the two irrigants in the present study did not reach statistical significance by Day 7.

Pain assessment using the Wong-Baker Faces Pain Rating Scale revealed a comparable trend between the two groups, with progressive improvement over time. This finding corroborates the results of Sabe-Alarab et al. [11] and Sruthy et al. [13], who also reported that povidone-iodine and saline irrigation both effectively reduced postoperative pain, though povidone-iodine provided marginally better relief within the first 48 hours. The slight advantage of povidone-iodine may be attributed to its dual antimicrobial and anti-inflammatory actions, which reduce bacterial load and local tissue irritation at the surgical site [12,15].

Hemostasis was achieved within 24–48 hours in most patients across both groups, indicating that neither solution adversely affected clot stabilization or wound healing. This observation is supported by similar findings in previous studies, which suggest that povidone-iodine does not interfere with normal hemostatic mechanisms and may even promote tissue repair through microbial load reduction [11,14].

The present findings collectively support the use of povidone-iodine as a safe and cost-effective alternative to saline for irrigation in oral surgery. Its additional antimicrobial properties make it particularly beneficial in cases with high infection risk. However, as observed in this study and others [5,11,13], the long-term healing outcomes remain comparable between povidone-iodine and saline irrigation. Thus, the choice of irrigant may be guided by clinical judgment, cost-effectiveness, and patient comfort.

Some variability in findings across studies may be explained by differences in concentration and volume of povidone-iodine used, surgical techniques, and assessment methods for pain and edema. Additionally, variations in genetic and environmental factors influencing inflammatory responses among populations could contribute to discrepancies in clinical outcomes [8,10].

Conclusion

This study concludes that both povidone-iodine and normal saline are effective irrigating solutions in reducing postoperative pain and swelling following lower third molar surgery. Although povidone-iodine showed slightly better early postoperative outcomes, the overall difference between the two groups was not statistically significant. Owing to its broad antimicrobial spectrum, anti-inflammatory action, low cost, and availability, povidone-iodine may be considered a suitable adjunct during third molar extractions, particularly to minimize early postoperative discomfort. Future studies with larger sample sizes, multicenter designs, and varying concentrations of povidone-iodine are recommended to further validate its clinical benefits and optimize irrigation protocols for oral surgical procedures.

Authors' Contributions

All authors meet the ICMJE criteria for authorship. They have reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Author 1: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.

Author 2: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

Author 3: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.

Author 4: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

Author 5: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.

Author 6&7: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

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