Research Article

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Study of Effect of Povidone Iodine as an Anti-Oedematous Agent in Third Molar Surgery

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ABSTRACT

Background: Polyvinylpyrrolidone-iodine (PVP-I) irrigation is a simple and inexpensive solution with the potential to reduce surgical site infection the aim of this study was to evaluate the effect of Polyvinylpyrrolidone-iodine (PVP-I) 2% as an antioedematous agent in mandibular third molar surgery.

Materials and Methods: A single blind randomized control trial was carried out on 50 healthy outpatients requiring surgical removal of Mandibular third molars under local anesthesia. The patients were divided into 2 groups (n= 25), the treatment and control group. The treatment group patients were irrigated with PVP-I 2% (w/v) during bone guttering and tooth sectioning. The control group patients were irrigated with saline (sodium chloride 0.9% w/v) only. Procedures exceeding more than 1 hour were excluded from study. Using Pederson difficulty index, patients with moderately difficulty index were chosen. Parameters for swelling were recorded preoperatively, on first, second and seventh postoperative days. The data were statistically analyzed using SPSS (version 22.0) software.

Results: T-tests was applied for swelling and found more increase in swelling in saline group that was highly significant for change from preoperative to day 2 (p=.005) and from preoperative to day 7 (p-value<.001). Mean for Pederson index for both groups was found out to be same (P=1).

Conclusion: PVP-I 2% significantly reduced swelling as compared to saline suggesting that it acts as an anti-oedematous agent in mandibular third molar surgery.

Keywords: Povidone iodine, anti-oedematous, sodium chloride, third molar surgery.

INTRODUCTION

Iodine, one of the most efficient antiseptics has been used by the medical profession for over hundred years. The solution is effective against bacteria, fungi and viruses.[1] There are several problems inherent in the use of iodine as an antiseptic. Iodine is unstable and insoluble in water. To achieve a clinically applicable solution, solubility is attained using alcohol and salts of iodine. The resulting solution is irritating to the skin, causing local reactions of varying severity. The aqueous solution is of lower antiseptic value because the antiseptic I_2 must be converted into non-antiseptic I^-_3 in order to solubilize in water. In a search for substances which would reduce the undesirable side effects without alterations of the antiseptic properties of iodine, polyvinylpyrrolidone Iodine (PVP-I, Povidone) was studied. This water soluble polymer was utilized

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early as a blood volume expander and detoxifying agent.[2, 3] It was further developed as a drug vehicle and the solutions obtained produced a protective water soluble film on drying. Povidone acts as a carrier of iodine in water solutions. Shelanski and other investigators demonstrated that iodine in such solutions became a stable organic complex.[4, 5] The solubilised povidone-iodine has enhanced antisepsis as compared to an equivalent concentration of ordinary iodine because of a lesser amount of I^-_3. With the use of povidone-iodine, the germicidal action of the iodine is prolonged and the danger of cutaneous irritation, sensitization reactions and burns is minimized.[6] Polyvinylpyrrolidone-iodine (PVP-I) irrigation is a simple and inexpensive solution with the potential to reduce surgical site infection.[7] The antiseptic action is attributed to its toxicity towards microorganisms as it combines irreversibly with tyrosine residues of proteins, interferes with the formation of hydrogen bonding by some amino acids and nucleic acids, oxidizes sulfydryl groups and reacts with sites of unsaturation in lipids.[8] It is commonly used on intact skin in preparation for surgery and on open wounds. Acute lacerations are soaked in iodine and surgical wounds are freely irrigated with it. Various studies report that PVP-I irrigation prevents surgical site infection compared with saline, water or no irrigation.[7] In oral surgery, PVP-I is sometimes used as an irrigant for alveolar sockets following dental extraction. Extraction of diseased and malformed teeth is an essential part of oral surgery. The anti-inflammatory property of PVP-I when used as a topical applicant in burns is mentioned in some studies but there are no studies suggesting PVP-I as a specific anti-oedematous agent. Numerous studies have been carried out to assess the influence of various factors on postoperative course following surgical removal of mandibular third molar. [9] White head varnish (iodoform, balsam tolutan and styrax liquid in a base liquid) has been shown to reduce pain, swelling and trismus after topical application to sockets following extraction. [10] In that study, there was no mention of the possible anti-oedematous effects of iodine. In another study, tube drain was used after third molar surgery to reduce pain, swelling and trismus and they concluded that it helps in reducing swelling postoperatively.[11] This study was undertaken to evaluate the effect of PVP-I 2% as an anti-oedematous agent when used as an irrigant in low concentration during the surgical procedure.

MATERIALS AND METHODS

Ethics

A prospective study, approved by the M M University Institutional Ethics Committee and Board of Studies was conducted comprising of patients undergoing surgical removal of the lower third molar. A written informed consent was taken from the patients before conducting the study and it was single blind randomized control trial. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Study Design

This study was carried out on 50 healthy outpatients who need surgical removal of mandibular third molars under local anesthesia. The patients were divided into 2 groups (n = 25), the treatment (PVP-I) and control groups (normal saline). Inclusion criteria included healthy ambulatory patients (ASA class I) requiring removal of impacted lowers third molar that necessitated mucoperiosteal flap elevation, buccal bone guttering with or without sectioning of the tooth, moderately difficult impaction (difficulty index value 5-6) based on radiographic assessment (as described by PEDERSON[12]), age between 18 and 50 years (both genders), patients should not have swelling associated with impacted mandibular third molars, no use of medication that could interfere with the healing process, No systemic disease. Exclusion criteria included patients with systemic diseases, pregnancy, breast-feeding or any therapy that could interfere with the healing process, patients on medications those may interfere with healing process, patients above 50yrs of age or below 18yrs of age, patients having swelling in association with impacted mandibular third molars, patients having swelling in association with impacted mandibular third molars, history of hypersentivity to iodine, long-term non-steroidal anti-inflammatory drugs (NSAIDs) therapy.

In treatment group, patients were irrigated with PVP-I 2% (w/v) (Betadine, Win- Medicare, India) during bone guttering and tooth sectioning. The

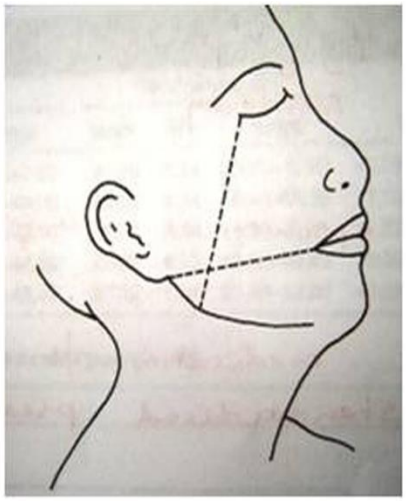

Fig 1: Horizontal and vertical guide for swelling measurement.

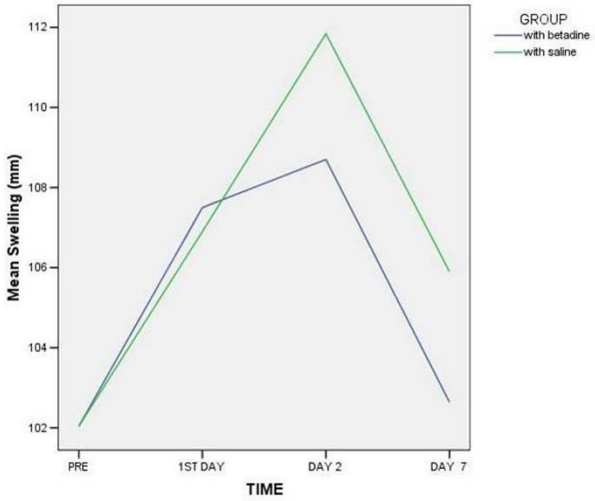

Figure 2: depicting swelling between two groups.

Fig 2: depicting swelling between 2 groups.

control group patients were irrigated with saline (sodium chloride 0.9%, w/v; Parentral Drugs, India) only. Irrigation with PVP-I 2% was done for less than five minutes. Procedures that exceeded more than 1 hour were excluded from the study. Routine laboratory investigations were carried out. Presurgical measurements for swelling were made. Third molar removal was performed in a standard way. Wound closure was achieved using 3-0 silk braided silk (the standard material used in India). After the surgery, details of the operation and duration of surgery (from incision to last suture) were recorded. The patients were reviewed on 1, 2 and 7 days post operatively. Swelling was measured using a horizontal and vertical guide with a flexible ruler. The horizontal measure corresponds to the distance between the labial cant and the ear lobe. The vertical measure corresponds to the distance between the external canthal of the eye and the angle of the mandible. The arithmetic mean of the 2 measures determined the facial measure [Figure 1]. Post extraction, all patients were prescribed only analgesic paracetamol 500 mg (1 tablet every 6 h for 2 days) following the authors routine protocol. All patients were discharged after having been given the usual postoperative instructions and advised to avoid any medications except those prescribed.

RESULTS

The study included 50 patients. Mean Operative time for Betadine group was 36.20 ±7.810 and that for Saline group was 37.32±6.511minutes. For the overall sample mean operative time was 36.76 ± 7.139 with range of 20 to 50 minutes. Independent t-test was applied for Operative time in minutes and we found the two groups were matched (p= .584, p>0.05) for operative time and the parameters are summarized in Table 1. In Betadine group swelling (in mm) for preoperative (pre.) visit was found to be as 102.04 ± 6.019, on Ist day postoperative (postoperative) 107.5± 5.270, 2nd day postoperative 108.7± 6.9026 and 7th day postoperative 102.64± 6.412. Swelling in Saline group on pre was 102.04± 6.019, 1st day postoperative was 106.90± 5.603, 2nd day postoperative was 111.840± 5.2096 and the 7th day postoperative 105.90± 6.450 and the parameters are summarized in Table 2. For change in swelling, T-tests were applied and we found more increase in swelling in saline group from preoperative to Day2 & from preoperative to Day7 which was highly significant for change Day2 (p= .005 **) & for Day7 (p-value <.001**) and the parameters are summarized in Table 3 , 4 & Figure 2. Mean for Pederson index for Betadine & saline group was 5.44±2.043 and it was found out to be non significant (same P= 1) and the results are summarized in Table 5. Continuous data was written as either in the form of its mean and standard deviation or in the form of its median and interquartile range, as per the requirement. The Normality of quantitative data was checked by measures of Kolmogorov-Smirnov tests of Normality. Mann-Whitney *U*-test was used for statistical analysis of skewed Continuous

Table 1: Mean operating time for both groups.

Report Operative time minutes					
With betadine/with saline	Mean	N	Std. Deviation	Minimum	Maximum
with betadine	36.20	25	7.810	20	50
with saline	37.32	25	6.511	25	48
Total	36.76	50	7.139	20	50

Table 2: NPar tests for swelling between both groups.

Descriptive Statistics									
With betadine/with saline		N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
							25th	50th (Median)	75th
with betadine	Swelling (mm)Pre	25	102.04	6.019	93	113	97.50	100.00	106.75
	Swelling (mm) 1st day	25	107.50	5.270	98	115	103.75	107.50	112.50
	Swelling (mm) 2nd day	25	108.700	6.9026	95.0	122.5	103.750	107.500	112.500
	Swelling (mm) 7th day	25	102.64	6.412	93	118	97.50	102.50	106.75
with saline	Swelling (mm)Pre	25	102.04	6.019	93	113	97.50	100.00	106.75
	Swelling (mm) 1st day	25	106.90	5.603	100	118	101.25	105.00	111.25
	Swelling (mm) 2nd day	25	111.840	5.2096	105.0	122.5	107.500	110.000	116.250
	Swelling (mm) 7th day	25	105.90	6.450	95	120	102.50	105.00	110.00

Table 3: T-test for swelling between 2 groups.

Group Statistics					
	With betadine/with saline	N	Mean	Std. Deviation	Std. Error Mean
SwellingmmPREtoD1	with betadine	25	-5.4600	2.58972	.51794
	with saline	25	-4.8600	2.34307	.46861
SwellingmmPREtoD2	with betadine	25	-6.6600	4.55686	.91137
	with saline	25	-9.8000	2.89396	.57879
SwellingmmPREtoD7	with betadine	25	-.6000	2.07666	.41533
	with saline	25	-3.8600	3.35261	.67052

Table 4: Independent sample test for swelling between 2 groups.

Independent Samples Test							
	t-test for Equality of Means						
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
SwellingmmPREtoD1	-.859	48	.395	-.60000	.69847	-2.00438	.80438
SwellingmmPREtoD2	2.908	48	.005**	3.14000	1.07963	.96926	5.31074
SwellingmmPREtoD7	4.133	48	<.001**	3.26000	.78873	1.67415	4.84585

Table 5: Comparison for Pederson index between 2 groups for pre to NPar test .

Descriptive Statistics									
With betadine/with saline		N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
							25th	50th (Median)	75th
with betadinw	Pederson index	25	5.44	2.043	2	10	4.00	5.00	6.00
with saline	Pederson index	25	5.44	2.043	2	10	4.00	5.00	6.00

variables (swelling & Pederson index). For normally distributed data (age & operative time) comparison of 2 groups was done student t- test. Wilcoxon Signed rank test was applied to compare time related variables. All the statistical tests were two-sided and were performed at a significance level of α=.05. Analysis was conducted using IBM SPSS statistics (version 22.0).

DISCUSSION

Polyvinylpyrrolidone- iodine (PVP-I) is a widely used antiseptic introduced by Shelanski H.A. and Shelanski M.V. in 1956 which results from the combination of molecular iodine and Polyvinylpyrrolidone.[13] Povidone is hygroscopic and readily soluble in water. It is also a thickening and dispersing agent with tablet binding capacity. Iodine has a corrosive effect on tissues due to its oxidizing potential. Oedema and pain are the most common sequelae following surgical removal of mandibular third molars. A large variety of anti-inflammatory and antibacterial drugs have been used to prevent these postoperative symptoms. In this study, we found that PVP-I 2% irrigation was effective in reducing postoperative oedema on 2nd and 7th postoperative days as compared to saline irrigation. The inflammation response is defined by adhesion of circulating leukocytes to microvascular endothelium and subsequent extra-vasation into tissues. Three distinct phases have been postulated like the initial attachment and rolling of leukocytes along vessel wall, firm adhesion and transmigration into extra-vascular tissues.[14] Blockage or inhibition of any kind of these steps impedes inflammatory process. Postoperative swelling after third molar surgery is associated with trauma, heat, anoxia, tissue and cellular destruction. There is also release of inflammatory mediators such as histamine, bradykinin, prostaglandins and leukotrienes.[15] There is increase in surgical wound concentration of prostaglandins E2 (PGE2) and leukotriene B4 (LTB4) following mandibular third molar surgery. PGE2 and LTB4 contribute to pro inflammatory processes including pain, vasodilatations, plasma extravasations and inflammatory/immune cell chemotaxis.[16] In patients with history of pain and dysfunction of temporomandibular joint, PGE2 and LTB4 levels are raised in their synovial fluid aspirates. Leukotriene A is identical to slow reacting substance released in anaphylaxis and LTB4 is potent chemotactic substance and they contribute to inflammation and swelling. Inhibition of chemotaxis prevents accumulation of neutrophils (inflammatory cells) which could increase cytochrome c oxidase (COX) availability for metabolism of arachidonic acid into prostaglandins therefore reducing oedema and pain following third molar surgery. PVP-I in low concentrations inhibits leukocyte chemotaxis (leukocyte extravasation) both in vivo and in vitro studies.[13] In vivo there is also a significant inhibition of human polymorphonuclear leukocyte migration and fibroblastic activity with PVP-I. The toxicity of PVP-I at cellular level is directly proportional to concentration of solution used. Iodine also destroys protein and peptide based microbial pathogenic factors, tissue destructive enzymes and cytokines thus impeding inflammatory tissue destruction and promoting wound healing. PVP-I as irrigant is cheap and does not impede visualization of surgical field as it's used in low concentration and acts as antiseptic, haemostatic and anti-oedematous agent. From this study, it can be concluded that PVP-I has an anti-oedematous effect in third molar surgery. Further studies are required to elucidate the mechanism of action.

CONCLUSION

From the results of this study, it was concluded that Povidone Iodine irrigation significantly ($p<0.001$) controlled oedema as compared to saline suggesting that Povidone Iodine 2% acts as an anti-oedematous agent in mandibular third molar surgery.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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