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Clinical and Biomarker Assessment of Two Medicaments on Post-Extraction Pain, Inflammation, Socket Healing, and C-Reactive Protein Levels

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Abstract

Background: Dried socket (alveolar osteitis) is an unwanted complication after tooth extraction, and is often described as painful and delayed healing. Some medicaments are used to treat the condition. However, the comparison of the efficacy of *Aloe Vera* gel and Alvogyl, as medicaments to heal extraction socket, and inflammatory control, is still lacking. **Objectives:** This study aimed to compare the two medicaments in term of pain and inflammation control, and healing of extraction socket, and levels of C-reactive proteins (CRP). **Methodology:** A comparative prospective observational clinical study was conducted at the Department of Oral and Maxillofacial Surgery at Clinic from February to July 2025. A total of 150 patients, scheduled for tooth extraction, were randomly allocated to two groups, Group A (*Aloe Vera* gel) and Group B (Alvogyl). Pain was assessed using Visual Analog Scale (VAS), inflammation was assessed using Soben Peter's criteria, and healing was assessed using formation of granulation tissue and seen at follow-up visit on days 3, 5, 7, and 10. Levels of C-reactive proteins (CRP) were analyzed using a Mindray BS-240 CRP analyzer. Data were statistically analyzed using SPSS v27. Appropriate t-tests, ANOVA, and chi-square tests were performed. **Results:** Both groups demonstrated significant decrease in pain level and CRP values during the follow-up. Patients in the *Aloe vera* group, however, showed earlier formation of granulation tissue, faster coverage of the socket and lower VAS values, compared to the Alvogyl group ($p<0.05$). Levels of CRP in *Aloe vera* group demonstrated a more pronounced downward trend, reflecting less systemic inflammation. No major complications were noted in either group. **Conclusion:** The results of this study show that *Aloe vera* gel is more effective than Alvogyl in managing post extraction pain, inflammation, and risk of dry socket while aiding healing in the age group of 31-50 years. *Aloe vera* gel is clinically recommended to minimize post extraction complications, especially for the lower jaw extractions of the middle age group. More research is needed on the other mechanisms of actions and effects of *Aloe vera* gel in the long run.

Key words: Intra Alveolar, *Aloe vera* Gel, Alvogyal, Wound Healing, Post Extraction Socket

1. Introduction

Tooth extraction is characterized as the painless removal of an entire tooth or its root, in dental practice and is often performed due to caries, periodontal disease, orthodontic reasons or impaction. Ensuring minimal stress to the surrounding tissues hence facilitating uncomplicated soft tissue healing and preventing postoperative complications (Jain, 2021).

Dry socket is a well-known post-extraction complication. This generally occurs 1-4 days after surgery and is characterized by an inflammation of the extraction socket with severe throbbing pain and loss of the blood clot (Tarakji *et al,* 2015; Yadav *et al,* 2019). As it occurs in the recovery period, there is an effort to find non-invasive traditional treatments for it.

Several earlier investigations documented varying rates of dry socket, from 1 to 4% in straightforward extraction of permanent teeth to 5 to 30% in surgical removal of impacted mandibular third molars, It rarely occurs in children (Kamal *et al*,.2022).

Aloe vera contains anti-inflammatory, antibacterial and immune-boosting compounds which are useful in dental and periodontal health and in general health maintenance. It is useful in treating mucous membrane irritations and local infections. It is reported to be free of side effects and allergic reactions, and is, therefore, useful as a therapeutic agent (Kumar *et al.,* 2024).

Aloe vera gel is strongly bactericidal and produces significant growth inhibition zones against all cariogenic and periodontopathic oral bacteria. It has been reported that *Aloe vera* gel has a mean minimum inhibitory concentration (MIC) of 12.5 µg/ml against clinical isolates of *S. mutans* (Subramaniam *et al.,* 2014).

Alvogyl is an intra-socket fibrous dressing containing butamben (25.7%), an anesthetic agent, and iodoform (15.8%), an antimicrobial agent, to help manage dry socket. It also contains eugenol (13.7%), a natural product with anti-inflammatory activity to inhibit prostaglandins and pain (Eshghpour *et al.,* 2015) and penghawar (3.5%).

Alhalbi *et al.* (2023) performed a split-mouth clinical study on 20 patients (40 sockets) and found topical application of Aloe vera gel in the intra-alveolar position reduced the occurrence of alveolar osteitis (dry socket) when compared to Alvogyal ($p < 0.05$). Furthermore, Aloe vera gel promoted overall healing of the sockets and decreased post-extraction pain on the 3rd and 7th days, when compared to the control.

2. Objectives

The current study was aimed to assess the efficacy of *Aloe vera* and alvogyal to reduce the alveolar osteitis (Dry Socket), determine the mean time required for the transition from granulation tissue formation to complete healing of the dental socket following the application of *Aloe vera* compared to Alvogyal, and to compare the mean time required for complete pain relief following the application of *Aloe vera* and Alvogyl complication such as dry socket.

3. Material and Methods

3.1 Details of the Study Population:

A total of 150 patients were enrolled in this single center prospective observational study which was conducted at the Ekram clinic from February to July 2025.

3.2 Patient Selection:

Patients in the range of 15-70 years of age were included in the study, and patients outside this age range were excluded. Pregnant patients, patients with uncontrolled systemic disorders, and patients with known allergy to the drugs used in this study were excluded.

3.3 Ethical Considerations:

Ethics committee approval (NBC:002.H-25.31) in accordance with Helsinki declaration was obtained, ensuring informed written consent and 100% confidentiality.

3.4 Methodology:

One hundred and fifty patients were randomly divided into two groups, Group A (1 ml Aloe vera gel) and Group B (0.2 g Alvogyal).

3.5 Local anesthesia:

Lidocaine 2% with epinephrine 1: 100,000 was used for nerve blocks and local infiltration anesthesia.

3.6 Tooth extraction and elevators:

Teeth were trauma extracted by using elevators to cut periodontal ligaments and enlarge alveolar sockets to prevent root fracture.

3.6.1 Forceps:

Tooth extractions were aided by the use of forceps in atraumatic technique; mandibular extractions were done using palm-down technique and maxillary extractions were done using palm-up technique. Healing was assessed by scheduled recall visits.

3.6. 2 Pain and inflammation:

Pain was assessed by visual analogue scale (0-10) and inflammation in the socket was assessed by Soben Peter criteria (0-3).

3.6. 3 Healing and CRP:

Healing was assessed by the presence of granulation tissue and the degree of coverage of the socket (0-5), and serum CRP level was assessed by photo metric analysis at 24 to 48 hours.

3.7 Statistical analysis:

Continuous and categorical variables were analyzed in SPSS Version 27, using analysis of variance (ANOVA) and chi square tests, where a value of $p < 0.05$ was considered to be statistically significant.

4. Results

4.1. The descriptive characteristics of the study sample

The total sample consisted of 150 participants of whom65 (43.3%) were males and 85(56.6%) were females.

Table 1: demographic characteristic of the study sample according to gender

Gender	Frequency	Percent
Male	65	43.3
Female	85	56.6
Total	150	100.0

The total sample consisted of 150 participants and majority of participant were within the31-50years age group (41.3%), followed by those aged 15-30years (33.3%), and while participant aged 51-70years represented 25.3% of the sample.

Table 2: demographic characteristic of the study sample according to ages

Age Group	Frequency	Percent
15-30	50	33.3
31-50	62	41.3
51-70	38	25.3
Total	150	100.0

4.2. Distribution of age

4.2.1. Age related Variations in Pain and Healing Scores for Aloe vera Treatment

Table 3 shows the different age groups of patients treated with intra-alveolar Aloe vera gel after tooth extraction experienced different levels of pain and healing. Three age groups were created from the participants: 15–30, 31–50, and 51–70 years. In order to determine if age had a statistically significant impact on both pain perception and wound healing response, the one-way ANOVA test's mean, standard deviation, and findings are displayed in the table. While the differences in pain levels across age groups were not statistically significant (p = 0.332), there was a significant variance in healing scores (p = 0.039).

Table 3: Age related Variations in Pain and Healing Scores for *Aloe vera* Treatment

Variable	Age group	N	Mean	Standard deviation	F value	P value
Pain score	15-30	30	1.20	1.495	1.122	0.332
	31-50	28	1.50	1.528		
	51-70	17	0.77	1.235		
Healing score	15-30	30	4.73[a]	1.999	3.417	0.039
	31-50	28	5.29[ab]	1.82		
	51-70	17	3.92[ac]	1.038		

*a mean no significant difference *b,c mean significant difference

An analysis of variance (ANOVA) (Table 3) was conducted to examine whether pain and healing scores varied by age group among patients treated with intra-alveolar *Aloe vera* gel.

For pain scores, the results showed no statistically significant differences across the age groups 15–30 (M = 1.20, SD = 1.50), 31–50 (M = 1.50, SD = 1.53), and 51–70 (M = 0.77, SD = 1.24), $F = 1.12$, $p = 0.332$. This suggests that age did not significantly influence the reported pain levels following *Aloe vera* treatment.

In contrast, healing scores differed significantly among age groups, $F = 3.42$, $p = 0.039$. Post hoc comparisons indicate that participants aged 31–50 years (M = 5.29, SD = 1.82) experienced better healing outcomes compared to those aged 51–70 years (M = 3.92, SD = 1.04), while the 15–30 age group (M = 4.73, SD = 2.00) had intermediate scores. These results suggest that middle-aged individuals may benefit most in terms of healing efficiency when treated with *Aloe vera* gel.

4.2.2. Age-Related Variations in Pain and Healing Scores for Alvogyal Treatment

Age is an important factor that can influence both pain perception and healing process following dental procedure such as tooth extraction. The present analysis aimed to evaluation mean value within age group

Table 4: Age-Related Variations in Pain and Healing Scores for Alvogyal Treatment

Variable	Age group	N	Mean	Standard deviation	F value	P value
Pain score	15-30	20	3.60	2.303	0.971	0.383
	31-50	34	4.24	2.136		
	51-70	21	3.52	2.064		
Healing score	15-30	20	7.80[a]	2.093	5.329	0.007
	31-50	34	9.37[b]	1.532		
	51-70	21	8.33[a]	2.082		

*a mean no significant difference *b mean significant difference

A one-way ANOVA (Table 4) was conducted to assess the effect of age on pain and healing scores among individuals receiving Alvogyal treatment following tooth extraction.

For pain scores, no statistically significant differences were found between the age groups 15–30 years (M = 3.60, SD = 2.30), 31–50 years (M = 4.24, SD = 2.14), and 51–70 years (M = 3.52, SD = 2.06), $F = 0.97$, $p = 0.383$. This indicates that pain perception after treatment with Alvogyal was consistent across age groups.

However, healing scores showed a statistically significant difference across age groups, $F = 5.33$, $p = 0.007$. Specifically, participants aged 31–50 years (M = 9.37, SD = 1.53) had significantly higher healing scores compared to those aged 15–30 years (M = 7.80, SD = 2.09) and 51–70 years (M = 8.33, SD = 2.08). These findings suggest that individuals in the 31–50 age range may experience more effective wound healing outcomes with Alvogyal treatment.

4.3. Gender variation

4.3.1. Gender-Related Variations in Pain and Healing Scores for *Aloe vera* Treatment

The gender-related variations in pain and healing scores among patients treated with intra-alveolar *Aloe vera* gel following tooth extraction. The participants were classified according to gender into male and female groups. The table (5) presents the mean values, standard deviations, and the results of the independent samples t-test performed to determine whether there were significant differences between males and females regarding pain perception and socket healing. The results showed no statistically significant difference in pain scores between males and females (p = 0.526). However, the healing scores were higher in females compared to males, with a near-significant difference (p =0.081), suggesting that gender may have a minor influence on the healing process following *Aloe vera* treatment

Table 5: Gender-Related Variations in Pain and Healing Scores for *Aloe vera* Treatment

Variable	Gender	N	Mean	Standard deviation	F value	P value
Pain score	Male	35	1.08	1.442	-0.637	0.526
	Female	40	1.32	1.491		
Healing score	Male	35	4.33	1.274	-1.774	0.081
	Female	40	5.04	1.732		

An independent samples *t*-test (Table 5) was performed to examine gender differences in pain and healing outcomes following intra-alveolar *Aloe vera* treatment.

For pain scores, no statistically significant difference was found between males (M = 1.08, SD = 1.44) and females (M = 1.32, SD = 1.49), $t = -0.64$, $p = 0.526$. This indicates that perceived pain levels post-treatment was similar for both genders.

Regarding healing scores, the difference between males (M = 4.33, SD = 1.27) and females (M = 5.04, SD = 1.73) approached significance but did not reach the conventional threshold, $t = -1.77$, $p = 0.081$. While females had a slightly higher mean healing score, this difference was not statistically significant, suggesting that gender may not play a major role in healing outcomes following *Aloe vera* application.

4.3.2. Gender-Related Variations in Pain and Healing Scores for Alvogyal Treatment

Gender is another biological factor that influences the perception of pain tissue healing after dental procedures. The participants were classified according to gender into male and female groups.

Table 6: Gender-Related Variations in Pain and Healing Scores for Alvogyal Treatment

Variable	Gender	N	Mean	Standard deviation	F value	P value
Pain score	Male	30	4.38	2.300	1.336	0.186
	Female	45	3.67	2.082		
Healing score	Male	30	9.16	1.801	1.305	0.196
	Female	45	8.51	1.980		

An independent samples *t*-test (Table 6) was conducted to assess whether gender influenced pain and healing outcomes following treatment with Alvogyal.

For pain scores, there was no statistically significant difference between males (M = 4.38, SD = 2.30) and females (M = 3.67, SD = 2.08), $t = 1.34$, $p = 0.186$. This indicates that perceived pain levels after treatment with Alvogyal did not differ meaningfully by gender. Similarly, healing scores did not significantly differ between males (M = 9.16, SD = 1.80) and females (M = 8.51, SD = 1.98), $t = 1.31$, $p = 0.196$. These results suggest that the effectiveness of Alvogyal in promoting healing was comparable between male and female participants.

4.4. Assessment of the Incidence of Dry Socket

4.4.1. Incidence of Dry Socket among *Aloe vera* and Alvogyal Treatments

The incidence of dry socket is a critical parameter in evaluation the effectiveness of material used in post extraction care. Both *Aloe vera* and Alvogyal have been widely applied in the management of extraction socket.

Table 7: Incidence of Dry Socket among *Aloe vera* and Alvogyal Treatments

Material	Dry socket				Chi square	P value
	No		Yes			
	Count	%	Count	%		
Aloe vera	52	34.7	23	18.0	8.382	0.004
Alvogyal	30	20.0	45	27.3		
Total	82	54.7	68	45.3		

A chi-square test of independence (Table 7) was performed to examine the association between treatment type (*Aloe vera* vs. Alvogyal) and the incidence of dry socket. The test revealed a statistically significant association between treatment type and dry socket occurrence, $\chi^2 = 8.382$, $p = 0.004$.

Notably, *Aloe vera* was associated with a lower incidence of dry socket (18.0%) compared to Alvogyal (27.3%). Conversely, a greater proportion of patients in the *Aloe vera* group (34.7%) did not develop dry socket compared to the Alvogyal group (20.0%). These findings suggest that *Aloe vera* may be more effective than Alvogyal in preventing dry socket following dental extraction.

4.4.2. Incidence of Dry Socket among upper and lower Treatments

To assessment whether a relation exists between upper and lower jaw and the incidence of dry socket, the following (table 8) present the distribution and frequency of case.

Table 8: Incidence of Dry Socket among upper and lower Treatments

Jaw	Dry socket				Chi square	P value
	No		Yes			
	Count	%	Count	%		
Upper	30	20.0	32	21.3	1.682	0.195
Lower	51	34.7	36	24.0		
Total	81	54.7	68	45.3		

A chi-square test of independence (Table 8) was conducted to evaluate the relationship between jaw location (upper vs. lower) and the incidence of dry socket. The results indicated no statistically significant association between jaw location and dry socket occurrence, $\chi^2 = 1.68$, $p = 0.195$.

Although a higher percentage of dry socket cases was observed in the lower jaw (24.0%) compared to the upper jaw (21.3%), this difference did not reach statistical significance. Thus, the incidence of dry socket does not appear to differ meaningfully based on whether the extraction was performed in the upper or lower jaw.

4.4.3. Site distribution of dry socket in the lower jaw

Table 9 present an analysis of distribution site of dry socket in lower jaw after tooth extraction according to the site of the tooth. the table shows the number of sockets that not develop dry socket (no) and those that did (yes) for each tooth number. This analysis helps identify the tooth sites that are the highest risk of developing this complication post extraction.

Table 9: Site distribution of dry socket in lower jaw

Tooth Name (Tooth number)		Dry socket		Total
		No	yes	
Central Incisor (1)	Count	1	1	2
	% within Dry socket	2.0%	2.8%	2.3%
Lateral Incisor (2)	Count	2	1	3
	% within Dry socket	3.9%	2.8%	3.4%
Canine (3)	Count	1	1	2
	% within Dry socket	2.0%	2.8%	2.3%
First Premolar (4)	Count	5	1	6
	% within Dry socket	9.8%	2.8%	6.9%
Second Premolar (5)	Count	8	4	12
	% within Dry socket	15.7%	11.1%	13.8%
First Molar (6)	Count	20	13	33
	% within Dry socket	39.2%	36.1%	37%
Second Molar (7)	Count	7	6	13
	% within Dry socket	13.7%	16.7%	14.9%
Third Molar (8)	Count	7	9	16
	% within Dry socket	13.7%	25.0%	18.4%
	Total	51	36	87

The highest incidence of dry socket was observed in the mandibular first molar (13 cases, 36%), followed by the mandibular third molar (9 cases, 25%). The mandibular second molar accounted for 6 cases (16.7%), while the mandibular second premolar showed the lowest incidence with 4 cases (11%).

4.5. Assessment of pain, inflammation, wound healing score and CRP level

4.5.1. Comparative Analysis of Pain, Healing, Inflammation Scores, and C - reactive protein Levels between *Aloe vera* and Alvogyal Treatments

The following table illustrates the comparison of pain, inflammation, and wound healing parameters, in addition to the mean C-reactive protein (CRP) levels among all participants in the study. Pain was assessed using the Visual Analog Scale (VAS), inflammation was evaluated clinically using a standardized scale, and wound healing was determined according to the healing index. CRP values are expressed in mg/L. The presented data represent the mean of means for all participants within each group or at each observation period, with standard deviation (±SD) provided where applicable to indicate variability.

Table 10: Comparative Analysis of Pain, Healing, Inflammation Scores, and C - reactive protein Levels between *Aloe vera* and Alvogyal Treatments

Variable	Material	N	Mean	Standard deviation	T value	P value
Pain score	*Aloe vera*	75	1.24	1.468	-8.850	< 0.001
	Alvogyal	75	3.89	2.160		
Healing score	*Aloe vera*	75	4.80	1.618	-13.404	< 0.001
	Alvogyal	75	8.70	1.937		
Inflammation score	*Aloe vera*	75	0.49	0.606	-11.255	< 0.001
	Alvogyal	75	1.82	0.813		
C-reactive protein	*Aloe vera*	75	0.889	0.886	-11.402	< 0.001
	Alvogyal	75	3.333	1.660		

A comparative analysis (Table 10) was conducted to evaluate the efficacy of intra-alveolar application of *Aloe vera* gel versus Alvogyal in post-extraction socket healing, focusing on pain, healing, inflammatory response (inflammation score), and C-reactive protein (CRP) levels. Independent samples t-tests revealed statistically significant differences across all measured outcomes.

Participants treated with *Aloe vera* (n = 75) reported significantly lower pain scores (M = 1.24, SD = 1.47) compared to those treated with Alvogyal (n = 75; M = 3.89, SD = 2.16), t = -8.85, p < 0.001. Similarly, *Aloe vera* was associated with a significantly better healing score (M = 4.80, SD = 1.62) than Alvogyal (M = 8.70, SD = 1.94), t = -13.40, p < 0.001, indicating faster or more complete healing.

The information score, likely reflecting signs of inflammation, was significantly lower in the *Aloe vera* group (M = 0.49, SD = 0.61) compared to the Alvogyal group (M = 1.82, SD = 0.81),

t = -11.26, p < 0.001. Likewise, CRP levels were markedly reduced in the *Aloe vera* group (M = 0.889, SD = 0.886) compared to Alvogyal (M = 3.333, SD = 1.660), t = -11.40, p < 0.001.

Overall, these findings suggest that intra-alveolar application of *Aloe vera* gel is significantly more effective than Alvogyal in reducing pain, enhancing wound healing, and lowering inflammatory markers in post-extraction sockets.

4.5.2. Comparison of Healing Scores between Upper and Lower Jaw Treatments

Treatment sites of tooth extraction across the upper and lower jaws were included in the study sample. Out of all the sockets that were inspected, 87 (58%) were in the lower jaw and 63 (42%) were in the upper jaw. A comparison of the two anatomical regions' healing performance was made possible by this distribution. The mean healing scores for both jaws are displayed in Table 5, illustrating the variations in post-extraction healing results

Table 11: Comparison of Healing Scores between Upper and Lower Jaw Treatments

Variable	Jaw	N	Mean	Standard deviation	F value	P value
Healing score	Upper	63	5.40	1.894	-6.596	< 0.001
	Lower	87	7.85	2.635		

An independent samples t-test (Table 11) was conducted to compare healing outcomes between upper and lower jaw treatment sites. The results showed a statistically significant difference in healing scores, $t = -6.60$, $p < 0.001$. Specifically, sockets in the upper jaw ($M = 5.40$, $SD = 1.89$) exhibited significantly better healing outcomes than those in the lower jaw ($M = 7.85$, $SD = 2.64$), with lower scores indicating more favorable healing.

5. Discussion

The present study evaluated the comparative efficacy of intra-alveolar *Aloe vera* gel and Alvogyl in post-extraction socket healing, with particular attention to pain reduction, healing progression, inflammatory response, and the incidence of alveolar osteitis.

The current study demonstrated a significant advantage of *Aloe vera* over Alvogyl across nearly all measured outcomes, corroborating and extending the evidence base on the role of *Aloe vera* in oral wound healing. Similarly, Patients treated with *Aloe vera* reported significantly lower pain scores compared to those treated with Alvogyl. This is consistent with several clinical studies. Alhalbi *et al.* (2023) and Madan *et al.* (2022) both reported that *Aloe vera* significantly reduced postoperative pain compared to Alvogyl, attributing this effect to Aloe vera's anti-inflammatory and analgesic properties. Similarly, Nimma *et al.* (2017) and Xavier *et al.* (2020) demonstrated Aloe vera's superiority over controls in reducing pain levels during the first postoperative week. In contrast, Supe *et al.* (2018), Lenka *et al.* (2019), and Maulida *et al.* (2024) highlighted the analgesic benefits of Alvogyl, though these studies compared it to Zinc Oxide Eugenol (ZOE) rather than Aloe vera. Collectively, these findings support Aloe vera's efficacy in pain control, while recognizing that Alvogyl paste remains effective compared to older obtundent dressings.

Our results revealed significantly better healing scores in the *Aloe vera* group. This aligns with the observations of Nimma *et al.* (2017) and Xavier *et al.* (2020), who reported faster epithelialization and enhanced socket closure with Aloe vera. Madan *et al.* (2022) further confirmed Aloe vera's role in promoting soft tissue repair and increasing wound tensile strength. Histological evidence by Syrjanen & Syrjanen (1979), however, indicated impaired healing in Alvogyl-treated sockets due to persistent inflammation and foreign body reactions, which supports our finding that Aloe vera, outperforms Alvogyl in overall healing quality.

Age-related variations in healing were also observed in our study, with middle-aged adults (31–50 years) showing superior healing outcomes compared to younger and older groups, regardless of treatment. This trend was mirrored in the Alvogyl group as well, though less pronounced, suggesting that systemic or age-related tissue responses may modulate healing efficiency beyond treatment choice. supporting the findings of (Guo & DiPietro, 2010). This improvement may be due to a balanced immune response and stable hormonal levels that

support tissue repair. In this age range, good blood circulation and sufficient collagen production also help in faster healing. Younger individuals may have a stronger but less controlled inflammatory response, while older patients tend to show slower cellular activity and delayed tissue regeneration.

Aloe vera treatment was associated with significantly lower inflammation scores and reduced CRP levels compared to Alvogyl. These findings are in line with prior studies that describe Aloe Vera's anti-inflammatory action through inhibition of prostaglandin synthesis and stimulation of fibroblasts for collagen production (Nimma et al., 2017; Madan *et al.,* 2022). Conversely, Ryala *et al*. (2011) noted higher infection rates in Alvogyl-treated sockets, raising concerns about its potential to exacerbate inflammatory reactions, which may explain the higher CRP levels observed in our Alvogyl group.

The present results showed that *Aloe vera* significantly reduced the incidence of dry socket compared to Alvogyl, supporting the findings of Poor et al. (2002), Ali et al. (2021), and Alhalbi *et al.* (2023), who all demonstrated Aloe vera's protective effect against alveolar osteitis. While Alvogyl remains widely used in clinical practice (Supe *et al.,* 2018; Lenka ***et al.,*** 2019; Maulida *et al.,* 2024), its efficacy appears mainly in symptomatic pain relief rather than in preventing dry socket occurrence. Indeed, historical data (Syrjanen & Syrjanen, 1979; Ryala *et al.,* 2011) suggest that Alvogyl may even delay healing or increase infection risk in some contexts.

The current study also found that healing was superior in the upper jaw compared to the lower jaw, consistent with the well-documented greater vascularity and bone density differences in the maxilla versus mandible. Interestingly, neither gender nor age significantly influenced pain perception, although females showed a trend toward slightly better healing outcomes with Aloe vera. These results echo reports by Nimma *et al.* (2017) and Madan *et al.* (2022), where demographic factors did not appear to strongly affect Aloe vera's efficacy. Supe *et al.,* 2018; Lenka *et al.,* 2019; Yadav *et al.,* 2019, and Maulida *et al.,* 2024) affirm that Alvogyl provides rapid and effective pain relief in cases of dry socket, often outperforming older agents such as ZOE. However, the findings of Syrjanen & Syrjanen (1979), Ryala *et al.* (2011), and Khan et al. (2022) suggest that Alvogyl may be less effective in promoting long-term healing and in reducing inflammatory burden compared to Aloe vera. Thus, Alvogyl's utility may be best considered palliative, whereas *Aloe vera* demonstrates both symptomatic and regenerative benefits.

The higher incidence of dry socket in the mandibular region compatored to maxilla may be attributed to the thick cortical bone of the mandibule, which is believed to be the cause of inadequate blood supply penetration to the extraction site, and delays healing. In the present study, the mandibular jaw had a higher incidence of dry socket (24.0%) than the maxilla jaw (21.3%), Similarly Yadav *et al.* (2019) previous study reported a predominant of dry more common in the mandible than in the maxilla arch (77.5%) and maxillary arch (22.5%). The mandibular first molar region had the highest incidence of dry socket (45%), followed by the mandibular third molar region (7.5%) and the lower mandibular premolar region (7.5%).

The highest prevalence of dry socket occurrence in the current study was seen in the mandibular first molar (36%), which was followed by the third molar (25%), the second molar (16.7%), and the second premolar (11%). Similarly, Supe *et al.* (2018) found that the Mandibular first molars (43.58%) exhibited the highest prevalence of dry socket occurrence. These were followed by mandibular third molars (33.33%) and mandibular second molars (23.07%).

6. Conclusion

This study shows that *Aloe vera* gel is better than Alvogyl in reducing pain and inflammation (CRP levels) and preventing dry socket, as well as in promoting healing of the post-extraction socket. Healing was better in upper-jaw extractions and in the age group of 31-50 years. gender had no significant effect on pain and healing.

Overall, *Aloe vera* gel is better for minimizing post-extraction socket surgery complications and aiding in faster healing. There should be clinical preference given to using *Aloe vera* gel on post-extraction healing for the middle-aged and lower jaw extractions, along with the standard care of a patient regardless of gender. Long term outcomes and the mechanisms of action of *Aloe vera* gel are to be researched, as well as any potential systemic or risk factors affecting dry socket.

6.3. Limitation of study

This study is limited to a small, single-center sample, short follow-up, potential variability due to procedures and compliance, and the reliance on clinical and subjective measures rather than laboratory markers. Therefore, larger multicenter studies with various protocols, objective measures, and extended follow-up are warranted in order to validate our preliminary findings.

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