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A COMPARATIVE EVALUATION OF POSTOPERATIVE PAIN USING DICLOFENAC SODIUM TABLET AND TRANSDERMAL PATCH IN THE MANDIBULAR MOLAR EXTRACTIONS

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Abstract

Background and objective: The aim of the study is to compare and evaluate the post-operative analgesic efficacy of diclofenac transdermal patch over the diclofenac sodium tablet after the mandibular molar extraction under a randomized controlled clinical study.

Methods: 100 healthy individuals of both the sexes, age ranging between 18-40 years who are indicated for mandibular molar extractions are included in the study. Patients were divided randomly in to two groups with 50 each. Group A patients were received DICLOFENAC TABLET 50mg twice daily for three post operative days. Group B patients received DICLOFENAC TRANSDERMAL PATCH 100mg once daily for three post operative days. Post operative pain scores were recorded using VAS scale for the next three post operative days.

Conclusion: From this study we can arrive at a conclusion that, pain management was better with oral diclofenac tablet after 6 hours after the extraction. After the 12 hours, both the drug delivery systems provided equal analgesic effect. When compared overall analgesic performance of oral diclofenac tablet and transdermal patches after tooth extraction for three post operative days, diclofenac tablet provided slightly better results than the transdermal patches, which was statistically significant.

Keywords: Comparative analysis, transdermal diclofenac patch, diclofenac tablet.

Introduction: Pain is a complex, multifaceted experience that is defined as "an unpleasant sensory and emotional experience associated with either actual or potential tissue damage, or describe in terms of such damage" by the International Association for the study of pain.[1]

The pain of surgery is nociceptive and it is caused by tissue damage and it is transmitted by normal physiological pathways, acute and for short duration which subsides when the damaged tissue heals. Striving to achieve adequate postoperative analgesia that works conjointly with patient compliance has been an unremitting task for surgeons. [2]

The procedure of dental extraction has been associated with an unpleasant response. Ideal postoperative pain management requires elimination of pain and discomfort to the patient. Nonsteroidal anti-inflammatory drugs (NSAIDs) are most commonly used pain medications in dentistry. Diclofenac sodium is the most commonly prescribed NSAIDS after the minor oral surgeries.[4]

Diclofenac is available in various forms to treat pain like injectable, topical gel, ophthalmic solution, suppository, and transdermal patch to treat pain. Oral administration of diclofenac has its own adverse effects and it also carries the risks related to gastrointestinal and cardiovascular side effects. Therefore, in order to minimize these side effects some alternative has to be introduced which can provide equal effectiveness compared to parenteral and oral, but at the same time which minimizes the unwanted side effects. [1]

Diclofenac transdermal patch is a newly introduced delivery system for postoperative pain management. It bypasses the first pass metabolism offers painless administration, increased bioavailability, maintenance of constant and prolonged drug level, reduced frequency of dosing, minimization of inter and intra patient variability, self-administration, and easy termination of medication, leading to better patient compliance.[1]

Although there have been several studies on the effect of transdermal diclofenac usage in fields like acute muscle spasm, sports injuries, laparoscopic surgeries, its impact on pain control in oral surgical procedures is less known, making surgeons depend on the more familiar oral and parenteral routes. Hence, the purpose of this study was to highlight the effectiveness and compliance of diclofenac in a transdermal mode in minor oral surgeries. [2]

Materials & methodology: A prospective study was conducted on patients who are indicated for mandibular molar extraction, reporting as Outpatients in the 'Department of Oral and Maxillofacial Surgery', College of Dental Sciences & Hospital, Davangere. Consent for performing the study was obtained from the institutional ethical committee. **(Reference no. CODS/2048/2020-2021)**

A written consent form was obtained from each candidate after the nature of the study had been fully explained in the native language. A thorough case history was taken, and a total of 100 patients were divided into two groups:

Group 1 (control group, n=50) — Patients who will receive diclofenac tablet.

Group2 (Study group, n=50) — Patients who will receive transdermal diclofenac patch.

Inclusion criteria:

1. Patient willing to participate in the study.
2. Healthy individuals in the age group of 18-40 years, was selected irrespective of sex, caste, religion and socio-economic status.
3. Firm teeth which are indicated for mandibular molar extraction.
4. Surgical site free of active infection.

Exclusion criteria:

1. Periodontally compromised teeth.
2. Mandibular molar teeth which are indicated for transalveolar extractions.
3. Impacted mandibular third molar teeth are excluded from the study.
4. Patient allergic to diclofenac or any NSAIDS.
5. Patients with history of peptic ulcer.
6. Patients with hemorrhagic disorders.

7. Patients who are unwilling to participate in the study.
8. Subjects with any underlying systemic disease and compromised immunity.
9. Pregnant and lactating women are excluded from the study.

Procedure in detail: Patient's detailed Case History was taken. Intraoral periapical radiograph/Orthopantomography was taken to assess the overall condition of the tooth. All the extractions are performed under local anesthesia 2% with adrenaline **1:80000** (Lignox 2%). After the extraction one group was given oral diclofenac sodium tablet 50 mg (Divon 50mg.), twice daily for 3 days. and the other group was given matrix-controlled diclofenac patch 100 mg,50sq cm once daily for 3 days. The transdermal diclofenac patch 100 mg (Nu patch) was placed over the hairless skin area (right/ left shoulder) after the extraction. The patch was changed once daily for 3 days. Thus, placing a total of three patches over the 3 post-operative days.

Post-operative pain was be assessed by using 10 Point Visual Analog Scale (VAS). The VAS consists of a 10 cm horizontal or vertical line with the two endpoints labeled 'no pain' and 'worst pain ever.' The patient is required to mark the 10 cm line at a point that corresponds to the level of pain intensity he or she presently feels, the distance in centimeters from the low end of the VAS and the patient's mark is used as a numerical index of the severity of pain. The patients were be provided with the VAS form and will be instructed to mark the number according to the pain at 6, 12th hourly for 3 post-operative days. And the VAS form will be collected after the 3 postoperative days.

Adverse effects scores

GI Irritation Scores: Various gastrointestinal adverse effects such as abdominal pain, constipation, diarrhoea, dyspepsia, vomiting, nausea was noted and data collected in the form of numbers. If the GI irritation was present then number given was 1 and if the patient did not experience any GI irritation number given was 2.

I. Present
II. Absent

1. **Skin Allergy Scores:** Skin reactions like dry skin, pruritus, rash, vesicle or bulla formation were noted if any. Data collected in the form of numbers, which is as follows
   I. **P**resent
   II. Absent
2. **Patient Compliance Scores:** The patient satisfaction was assessed using questionnaire at the end of the third day by the participant during the study period. Each answer were given numbers and the data was collected.

Q. Are you satisfied with the mode of treatment?

1- Satisfied
2- Not satisfied
3- Neutral

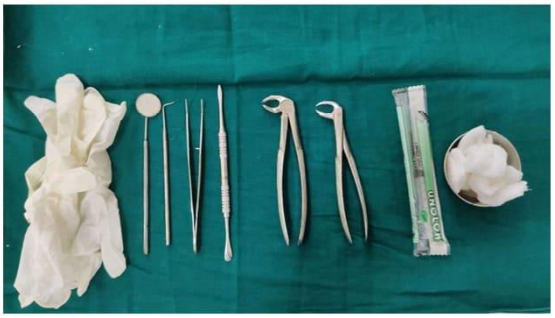

FIGURE 1- ARMAMENTARIUM FOR COLLECTION OF EXTRACTION.

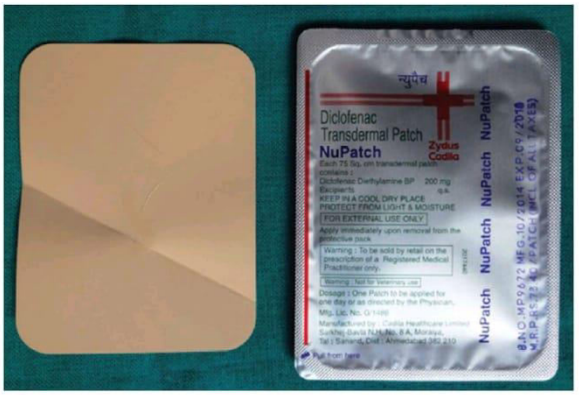

FIGURE 2 – NU PATCH

FIGURE 3 – SITE OF NU PATCH APPLICATION

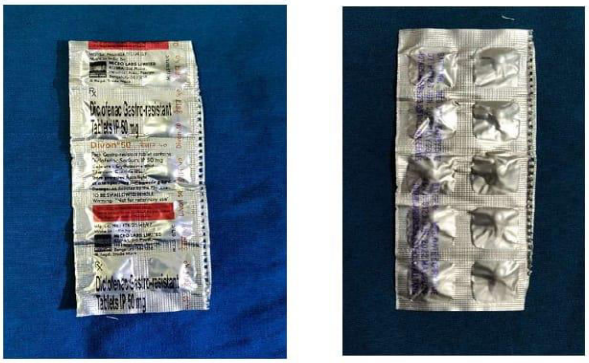

FIGURE 4 – TAB DIVON 50 MG.

Results: The present study was designed to compare and evaluate the "postoperative pain using diclofenac sodium tablet and transdermal patch in the mandibular molar extractions." The study population consisted of 100 individuals who were divided into 2 groups randomly. Group 1 and 2 consisted of 50 patients each who were indicated for mandibular molar extraction after Clinical Evaluation and radiographical investigation, detailed Case History was taken in the Department of Oral and Maxillofacial Surgery, College of Dental Sciences & Hospital, Davangere.

Table 1: Age and sex distribution: Majority of the study subjects in both group A and B is 27 (54%) and 20 (40%) respectively belonged to the age group of 33-40years, with the mean age of 32.56 ± 5.59 in group A and 29.44 ± 6.04 in group B. In both group most of the participants were males 26 (52%) in group A and 30 (60%) in group B. The difference between male and female proportion was not statistically significant. [**Table 1, 2]**

Table 2: Pain assessment scores: Pain assessment scores were measured by VAS method. The VAS consists of a 10 cm horizontal or vertical line with the two endpoints labelled 'no pain' and 'worst pain ever. And these scores were further categorised in to three subdivisions, those are mild (1-3), moderate (4-6) and severe (7-10).

Table 3: Pain after 6 hours: In Group A, 50% had severe pain after 6 hours on Day 1, versus 42% in Group B. Day 2 showed 74% (Group A) and 66% (Group B) with moderate pain. On Day 3, 64% (Group A) and 54% (Group B) experienced moderate pain. Significant statistical differences were noted only on Day 3 ($p < 0.048$). [**Table 3]**

Table 4: Pain after 12 hours: On Day 1, 62% (Group A) and 60% (Group B) had moderate pain, with 26% (Group A) and 30% (Group B) experiencing severe pain. Days 2 and 3 showed similar trends with no statistically significant pain differences between groups. [**Table 4]**

Table 5: Patient compliance: In group A, oral diclofenac tablet group among 50 patients 38 (76%) were happy, 10 (20%) were not happy and 2(4%) stayed neutral with the mode of treatment. Where as in group B transdermal patch group 27 (54%) were happy, 19 (38%) were not happy and 4(8%) stayed neutral with mode of treatment. The data collected on the third post operative day after completion of the course. The difference was statistically significant with p value p-value<0.10[**Table 5]**

Table 6: Adverse effect - GI irritation: In oral diclofenac tablet group out of 50 patients 42 (84%) has not experienced GI irritation and 8 (16) has experienced the gastric irritation. And the same follows with the transdermal patch group, 50 (100%) out of 50 patients has not experienced the GI irritation. The data is statistically significant with p value is 1 [**Table 6]**

Table 7: Adverse effect - Skin allergy: In both the group, oral diclofenac tablet and transdermal group out of total 100 patients none of the patients complained about the skin allergy. When the data compared between two groups it was statistically significant with p value 1. [**Table 7]**

Table 1: Age

GROUP A			**GROUP B**		
Age group (in years)	**N (%)**	**Mean (±SD)**	**Age group (in years)**	**N (%)**	**Mean (±SD**
18 — 25	7 (14)	32.56 (5.59)	18 — 25	14 (28)	29.44 (6.04)
26 — 32	16 (32)		26 — 32	16 (32)	
33 — 40	27 (54)		33 — 40	20 (40)	
Total	50 (100)		Total	50 (100)	

Majority of the study subjects were in between 33-40 years age group including both tablet and transdermal patch group.

Table 2: Sex:

GROUP A		**GROUP B**	
Sex	**N (%)**	**Sex**	**N** (%)
Male	26 (52)	Male	30 (60)
Female	24 (48)	Female	20 (40)
Total	50 (100)	Total	50 (100)

Table 2 - In both the groups majority of the participants were males but when data was not statistically significant.

Table 3: Pain after 6 hours:

After 6 hours						
	Mild N (%)	**Moderate** N (%)	**Severe** N (%)	**Total**	Chi square	p-value
	Day 1					
Group A	2 (4)	23 (46)	25 (50)	50 (100)	6.062	**0.048***
Group B	10 (20)	19 (38)	21 (42)	50 (100)		
	Day 2					
Group A	4 (8)	37 (74)	9 (18)	50 (100)	3.988	0.136
Group B	1 (2)	33 (66)	16 (32)	50 (100)		
	Day 3					
Group A	**11** (22)	32 (64)	7 (14)	50 (100)	2.271	0.321
Group B	10 (20)	27 (54)	13 (26)	50 (100)		

*p-value<0.05

Table 4: Pain after 12 hours:

	After 12 hours					
	Mild N (%)	**Moderate** N (%)	**Severe** N (%)	**Total**	Chi square	p-value
	Day 1					
Group A	6 (12)	31 (62)	13 (26)	50 (100)	0.250	0.882
Group B	5 (10)	30 (60)	15 (30)	50 (100)		
	Day 2					
Group A	10 (20)	38 (76)	2 (4)	50 (100)	1.714	0.424
Group B	15 (30)	32 (64)	3 (6)	50 (100)		
	Day 3					
Group A	22 (44)	27 (54)	1 (2)	50 (100)	1.704	0.426
Group B	16 (32)	32 (64)	2 (4)	50 (100)		

Table 5: Patient compliance:

Patient compliance						
	Agree N (%)	**Neutral N (%)**	**Disagree N (%)**	**Total**	**Chi square**	**p-value**
Group A	**38 (76)**	**2 (4)**	**10 (20)**	**50 (100)**	**5.321**	**0.069***
Group B	**27 (54)**	**4 (8)**	**19 (38)**	**50 (100)**		

*p-value<0.10

Table 6: Adverse effect — GI irritation:

Adverse effects					
GI irritation					
	Present N (%)	Absent N (%)	Total	Chi square	p-value
Group A	8 (16)	42 (84)	50 (100)	0.0	1*
Group B	0	50 (100)	50 (100)		

*p-value<0.05

Table 7: Adverse effect — Skin allergy:

Adverse effects					
Skin allergy					
	Present N (%)	**Absent N (%)**	**Total**	**Chi square**	**p-value**
Group A	**0** (0)	50 (100)	50 (100)	0.0	1
Group B	**0** (0)	50 (100)	50 (100)		

Discussion: Postoperative pain management is crucial for improving patient outcomes, yet it often remains inadequately treated. Diclofenac, a widely used NSAID, is employed in various forms such as tablets and transdermal patches to alleviate pain while minimizing side effects. Oral NSAIDs, including diclofenac tablets, face challenges like first-pass metabolism and gastrointestinal (GI) irritation due to their non-selective COX inhibition.

In contrast, transdermal patches deliver drugs through the skin, bypassing the GI tract and reducing systemic exposure. Although they mitigate GI complications, their efficacy can be hindered by skin barriers and variable absorption rates. Our study compared the efficacy of diclofenac tablets versus transdermal patches in managing postoperative pain following mandibular extractions.

Patients in Group A received 6 tablets of 50mg diclofenac twice daily for three days, while Group B received 3 transdermal patches (100mg each) once daily. Both groups received a consistent daily dose of 100mg diclofenac. Pain was assessed using the Visual Analog Scale (VAS), categorizing scores from mild to severe.

Results showed tablets provided superior pain relief shortly after extraction compared to patches, although both methods were comparable at the 12-hour mark. By Day 2 and 3, tablets consistently outperformed patches in managing moderate to severe pain. Patient satisfaction favored tablets due to ease of use, while patches were noted for their minimal systemic side effects but occasional local skin reactions.

Statistical analyses confirmed significant differences in pain management efficacy and patient satisfaction between tablets and patches, highlighting tablets' efficacy in controlling postoperative pain intensity. Future research could explore enhanced patch formulations to improve efficacy while maintaining safety.

In conclusion, while both diclofenac tablets and transdermal patches effectively manage postoperative pain, tablets demonstrate superior efficacy in controlling moderate to severe pain. Patient preference and ease of use contribute to tablets' higher satisfaction rates despite their potential for GI irritation. Transdermal patches offer a safer profile with fewer systemic adverse effects but may be less effective in pain management compared to oral tablets.

Age and sex distribution: In our study most of the study subject were between 33-40 years in both groups. In diclofenac tablet group mean age was 34 years while in transdermal group 32 years. Most of the study patients were male in both groups' males 26 (52%) and 30 (60%) group A and group B respectively. . Sex and age distribution among the study subjects between the two group was not statistically significant. **Dipti Samal, Niranjan Mishra et al in 2019** presented similar report to our study where age and sex distribution was not statistically significant. [2]

Post operative scores-:

Day 1 scores: On day one, pain scores on the VAS significantly decreased over time in both diclofenac tablet and patch groups, aligning with **Bhaskar et al.'s** findings. Diclofenac tablets were more effective within the first 6 hours. After 12 hours, most patients in both groups experienced moderate pain. In Group A (tablets), 62% reported moderate pain and 26% severe pain. In Group B (patch), the majority reported similar pain levels. Statistically, there was no significant difference between the groups after 12 hours, indicating both treatments were equally effective. However, diclofenac tablets provided better relief in the initial 12 hours.

Sriram Krishnan, Pankaj Sharma et al observed that transdermal diclofenac patch worked better when compared to placebo patch after 12 hours which was statistically significant in the first 12 hours but when 24 hours data is considered VAS scores were not statistically significant. as our study results supported the 6 hour results but not the 12 hours results."

Dr Isha kaur bagga, Dr Pratik jam et al observed in their study that both clinically and statistically diclofenac sodium worked better when given orally when compared to transdermal patch in the first 24 hours. [20]

DAY 2 SCORES: The study assessed postoperative pain management efficacy of diclofenac tablets versus transdermal patches on day two. After 6 hours, 74% of patients in the diclofenac tablet group reported moderate pain, compared to 66% in the transdermal patch group. Severe pain was reported by 18% in the tablet group and 32% in the patch group, with the difference being statistically significant ($p < 0.05$).

After 12 hours, 76% of the tablet group reported moderate pain, compared to 64% in the patch group. Mild pain was reported by 20% in the tablet group and 30% in the patch group. This data suggests that while most patients experienced moderate pain after 12 hours, a larger proportion of those using the patches experienced mild pain compared to those taking tablets.

Overall, diclofenac tablets were found to be more effective in managing postoperative pain than transdermal patches on day two.**Dr Isha kaur bagga, Dr Pratik jain et at** observed in their study that both clinically and statistically diclofenac sodium worked better when given orally when compared to transdermal patch on the day 2.

DAY 3 PAIN SCORES: On day three, six hours post-extraction, most patients reported moderate pain (VAS scores 4-6) in both groups, with significant pain reduction over time. Specifically, 64% (32 patients) in the diclofenac tablet group and 54% (27 patients) in the transdermal patch group experienced moderate pain, with the rest mainly reporting mild pain (VAS scores 1-3).

After 12 hours, 54% (27 patients) in the tablet group and 64% (32 patients) in the patch group still reported moderate pain, with a significant decrease in severe pain compared to previous days. Mild pain was more frequently reported in the tablet group.

The study supports findings by **Bhaskar** et al. and **Dr. Isha Kaur Bagga, Dr. Pratik Jain**, which showed a reduction in pain scores over time for both groups. Both diclofenac tablets and transdermal patches effectively managed pain over three days, avoiding the need for emergency pain medication. While transdermal patches had initially lower mean pain scores, the difference was statistically significant only after six hours. By 12 hours, both treatments were equally effective in pain reduction, with no significant difference between them.

In this study no patients required an emergency medication in both Group I diclofenac tablet and Group **II -** diclofenac patch, but in a comparative interventional study of **Baskhar et al.** about one patient out of twenty required emergency paracetamol tablets as an emergency medication in spite of transdermal patch.

Bachalli PS et al. observed that there was significant pain reduction in diclofenac tablet group on day 1, but there was no significant difference between oral diclofenac group and transdermal patch group on day 2 and day 3. [14]

Patient compliance: Group A patients received diclofenac tablets immediately post-extraction, while Group B had a transdermal patch applied to the arm. After three days, patients rated their compliance and comfort: 76% in Group A were happy, 20% were not, and 4% were neutral. In Group B, 54% were happy, 38% were not, and 8% were neutral. The satisfaction difference was statistically significant ($p < 0.10$). Overall, more patients were satisfied with oral tablets than the transdermal patch, although many were happy with the patch application.

Dipti Samal, Niranjan Mishra et al in 2019 presented similar report to our study where patient satisfactory and compliance was significant. [2]

Adverse effect -GI irritation: In this study 8 (16%) from diclofenac tablet group has complained about the GI irritation such as mild nausea, vomiting but none of the patient required medications for the same. Our study results support the study of **Bhaskar et al,** where he reported that two of twenty patients had gastric irritation.

Dipti Samal, Niranjan Mishra et al in 2019 reported that 11 patients had gastritis in the diclofenac tablet group which is statistically significant and similar to our study results and **Sriram Krishnan, Pankaj Sharma et al** reported the similar adverse effects in 13 patients which is significant and similar to our study results.

Adverse effects- skin allergy: The diclofenac transdermal patch was well tolerated, causing no local or systemic adverse effects. Minor events like pruritus and minor rashes were observed. Unlike Agarwal et al.'s findings of localized rashes, this study reported no such issues, likely due to rotating patch application sites. **Dr. Isha Kaur Bagga** and **Dr. Pratik Jain** found no skin allergies or erythema, confirming the patch's safety. **Predel et al. (2004)** also found the patch safe for sports injuries. Overall, the patch's safety was statistically significant and well-supported by this study and others.[6].

Conclusion: In conclusion, the findings of this prospective study, highlight the management of post operative pain after the mandibular molar teeth extraction. In this prospective comparative study of oral diclofenac tablet with diclofenac transdermal patch. The objectives pf the study were to evaluate the efficacy, side effects and patient compliance with both oral route and newly developed transdermal patch.

Following conclusions can be made out of present study:

1. Pain management was better with oral diclofenac tablet after 6 hours after the extraction. After the 12 hours, both the drug delivery systems provided equal analgesic effect.
2. When compared overall analgesic performance of oral diclofenac tablet and transdermal patches after tooth extraction for three post operative days, diclofenac tablet provided slightly better results than the transdermal patches.
3. Majority of the study patients tolerated well and did not exhibit any major local or systemic effects with both diclofenac tablet and transdermal patch including skin allergy.
4. Majority of the patient compliance was good for both the groups while few patients expressed slight disappoint with the transdermal patches and few towards oral diclofenac tablet because of gastric irritation.

This research has certain limitations. Applying these findings to a larger national population requires large-scale, multicentric investigations to support the study's findings because it was a unicentric study with a small sample size. It is challenging to generalise the one end result because each person's experience of pain is subjective.

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