Print ISSN: 2321-6379
Online ISSN: 2321-595X

Review Article

Optimizing Topical Diclofenac Emulgel Therapy in Osteoarthritis: Insights from Clinical Practice in India

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Abstract

Osteoarthritis (OA) is a highly prevalent, progressive joint disease associated with substantial pain, disability, and healthcare burden, for which safe and effective long-term analgesic strategies remain a clinical priority. Topical non-steroidal anti-inflammatory drugs (NSAIDs), particularly diclofenac, have emerged as an important option in this context, offering localized cyclo-oxygenase inhibition with markedly reduced systemic exposure compared with oral formulations, thereby also lowering gastrointestinal, hepatic, and cardiovascular adverse event risk. Emulgel-based diclofenac formulations further enhance this therapeutic profile by improving drug solubility, skin penetration, viscosity, and release characteristics, which collectively support greater bioavailability and patient acceptability than conventional topical preparations. This review article focuses on discussing the pharmacological rationale, clinical efficacy, and safety of topical diclofenac in OA and presents real-world insights from a survey of 43 Indian orthopedists on prescribing patterns and perceptions regarding topical diclofenac emulgel. Data from clinical studies further show that topical diclofenac provides clinically meaningful pain relief and functional improvements comparable to oral NSAIDs and superior to paracetamol, while mainly causing mild local skin reactions. In addition, contemporary guidelines (e.g., National Institute for Health and Care Excellence, Osteoarthritis Research Society International, ACR) recommend topical NSAIDs as first-line pharmacological therapy for localized OA, especially in older adults or patients at elevated risk of oral NSAID-related adverse events. Survey findings indicate high clinician confidence in diclofenac emulgel, with strong preference driven by its perceived efficacy, favorable tolerability, and aesthetic advantages in OA management strategies.

Key words: Diclofenac emulgel, Non-steroidal anti-inflammatory drugs topical therapy, Osteoarthritis pain relief, Osteoarthritis, Topical application, Topical diclofenac

INTRODUCTION

Osteoarthritis (OA) is a chronic, progressive, degenerative joint disease that affects more than 500 million people globally. It is characterized by structural and functional changes, including articular cartilage degradation, osteophyte formation, subchondral bone remodeling, and varying degrees of synovial inflammation. These pathophysiological changes lead to chronic pain and functional impairment, making OA the fourth leading cause of disability worldwide. As one of the most prevalent musculoskeletal disorders, OA represents a major public health concern due to its substantial impact on mobility, quality of life, and healthcare utilization. Although it can involve any joint, the condition most commonly affects the knees, hips, hands, and spine.[1,2]

Access this article online

www.ijss-sn.com

Month of Submission : 11-2025
Month of Peer Review : 12-2025
Month of Acceptance : 01-2025
Month of Publishing : 01-2026

Management of OA

Worldwide recognition of the important role topical non-steroidal anti-inflammatory drugs (NSAIDs) play in the management of osteoarthritic pain is evident from the increasing number of international societies and clinical practice guideline committees that support their use as an early treatment option.[1] Besides topical NSAIDs, other

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available formulations include those containing agents such as capsaicin, salicylates, and menthol, along with various Ayurvedic and herbal preparations.[3,4] However, robust clinical evidence supporting their efficacy in managing musculoskeletal pain remains limited.[3]

A large network meta-analysis found that topical NSAIDs deliver functional benefits in knee OA (KOA) that is similar to those of oral NSAIDs, while both outperform paracetamol. Compared with paracetamol and oral NSAIDs, topical NSAIDs were linked to a lower incidence of gastrointestinal (GI) adverse events in a pooled assessment of 122 randomized controlled trials. Real-world observational data further indicate that topical NSAIDs have a more favorable safety profile overall, with reduced rates of all-cause mortality, cardiovascular (CV) complications, and GI bleeding relative to paracetamol.[5]

Topical Diclofenac for Management of OA

Topical diclofenac penetrates the skin and reaches subdermal tissues, including synovial areas, to target pain and inflammation directly at the source. It primarily blocks cyclooxygenase-2 (COX-2) enzymes (COX-1/COX-2 IC_{50} ratio = 29), which convert arachidonic acid into prostaglandins, thromboxanes, and prostacyclins. This inhibition curbs prostaglandin synthesis, reducing sensitization of peripheral nociceptors to painful or mechanical stimuli [Figure 1].[6,7]

Topical diclofenac can be considered as a first-line option before oral NSAID use, especially for older patients with OA and those who have comorbid conditions and/or risk factors for various systemic (GI, hepatic, renal, or CV) adverse events associated with oral NSAIDs, particularly when used at high doses or for long durations.[1,8]

Topical diclofenac sodium is formulated as gels in concentrations typically ranging from 1% to 3%. Preparations containing 1–2% diclofenac are commonly prescribed for OA, with recommended daily application limits of up to 16 g for a single affected joint and up to 32 g for multiple joint involvement.[9]

Efficacy and Safety of Topical Diclofenac in OA

A systematic review and meta-analysis suggested that topical NSAIDs offer similar efficacy to that of oral NSAIDs in OA treatment, delivering comparable pain reduction and functional improvements. In addition, available safety evidence indicates that topical formulations may offer a more favorable profile than oral options [Figure 2].[10-13]

The systematic reviews and meta-analyses consistently support the efficacy of topical diclofenac for chronic OA pain, demonstrating meaningful benefits in both pain relief and functional outcomes compared with placebo.[6] Diclofenac sodium 1% topical gel (DSG 1%) effectively relieves arthritis pain and demonstrates good safety and tolerability in clinical studies.[14] In a large network meta-analysis of randomized trials and observational studies, mainly in KOA, diclofenac solution, gel, and patch all produced statistically significant reductions in pain and improvements in function vs. placebo, with patches showing the greatest effect size among topical NSAIDs. A subsequent systematic review of placebo-controlled studies in knee and hand OA reported that topical diclofenac achieved clinical success – typically defined as

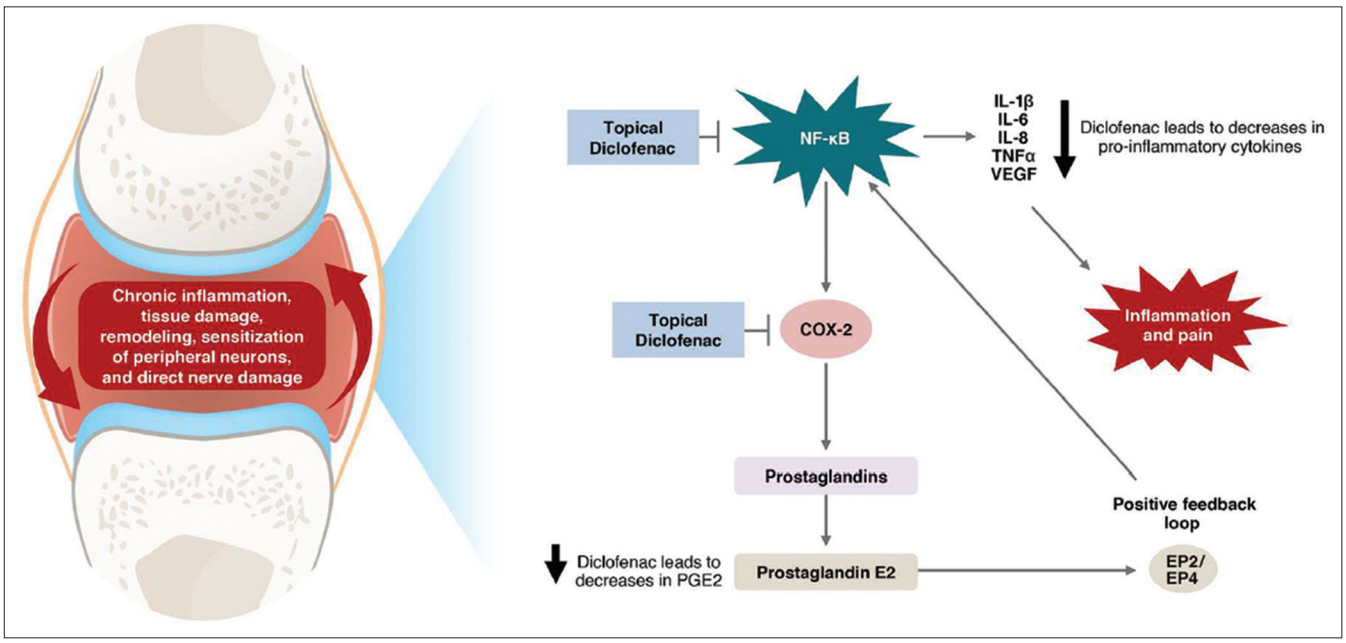

Figure 1: Topical diclofenac mechanism of action.[6] Adapted from Revel *et al. Rheumatol Ther.* 2020;7:217-36

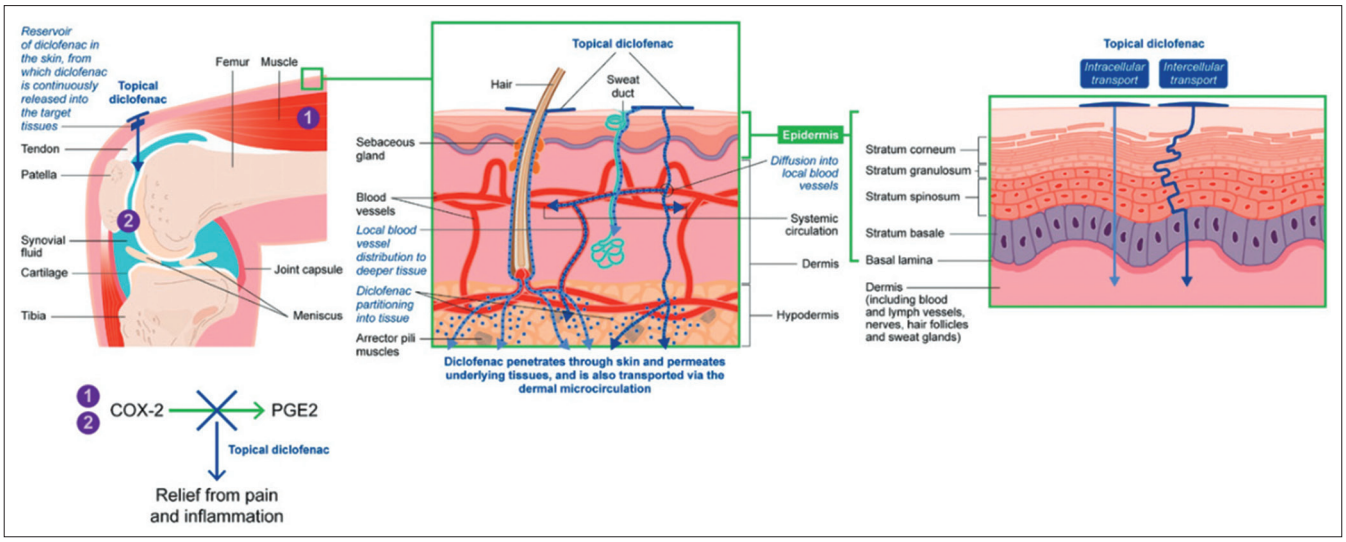

Figure 2: Penetration of topical diclofenac through the skin and permeation through the deeper layers to the inflamed joint.[10] Adapted from Hagen M *et al. Curr Med Res Opin*. 2017;33(9):1623-34

at least a 50% reduction in pain or a responder index – in a higher proportion of patients than placebo in both short- and medium-term trials.[6]

A pooled analysis of two KOA trials showed topical diclofenac produced fewer GI events than oral diclofenac (25.4% vs. 39.0%, $P < 0.0001$), including lower rates of dyspepsia (11.0% vs. 18.4%, $P = 0.001$), diarrhea (6.5% vs. 13.4%, $P = 0.0004$), abdominal distension (6.0% vs. 10.6%, $P = 0.01$), and upper abdominal pain (5.6% vs. 12.1%, $P = 0.0005$). Topical diclofenac also reduced abnormal liver enzymes, such as aminotransferase (10.4% vs. 22.2%, $P < 0.0001$), aspartate aminotransferase (7.0% vs. 14.6%, $P = 0.0004$), and gamma-glutamyl transferase (21.1% vs. 33.4%, $P < 0.0001$), though it increased dermatologic reactions such as dry skin (24.1% vs. 1.9%, $P < 0.0001$), pruritus and contact dermatitis. Across three trials versus oral NSAIDs, topical diclofenac lowered GI adverse event risk (relative risk [RR] 0.63; 95% confidence interval [CI] 0.53–0.73) but raised local skin reactions (RR 8.31; 95% CI 4.5–14). CV events trended lower with topical use (1.5% vs. 3.5%, $P = 0.055$), and a Taiwanese rheumatoid arthritis cohort confirmed reduced composite CV risk (hazard ratio 0.54; 95% CI 0.37–0.77) versus oral nonselective NSAIDs.[6]

The meta-analysis by Chen *et al.* demonstrated the efficacy and safety of topical diclofenac formulations (gel, solution and patch) for KOA, showing significant pain relief and functional improvements vs. placebo across short-term (1–2 weeks), mid-term (3–6 weeks), and long-term (8–12 weeks) periods. All formulations maintained favorable tolerability, primarily with mild local reactions. Topical gel and solution provided significant functional benefits in mid- and long-term follow-ups.[15]

Duration of Analgesic Effect of Topical Diclofenac in OA

The duration of analgesic effect is a key factor in pain management, as more frequent dosing often leads to poor adherence among patients with chronic pain. Improved compliance with analgesic therapy is associated with better symptom control, enhanced physical function, and increased patient satisfaction. In a randomized, double-blind, vehicle-controlled trial involving 260 adults with KOA, twice-daily application of 2% diclofenac sodium topical solution maintained consistent pain relief across the 12-h dosing interval, as reflected by stable WOMAC and NRS pain scores. This sustained efficacy may result from the slower elimination of diclofenac from inflamed tissues than from plasma.[6]

Nair and Taylor-Gjevre reported that the efficacy of topical diclofenac for OA of the knee has been consistently reported in several other efficacy studies, with therapy ranging from 4 to 6 and 12 weeks. Another study demonstrated that topical diclofenac sodium 1% gel achieved 5–17 times lower systemic absorption than oral diclofenac sodium in healthy volunteers.[16,17]

Emulgel Formulation and Related Advantages in Topical Drug Delivery

Not all the topical diclofenac formulations are the same

Skin permeation is not solely proportional to drug concentration; physicochemical properties significantly influence it. Diclofenac sodium exhibits higher transport rates than diclofenac diethylamine due to its superior saturation solubility. Formulation vehicles (gels, emulsions, liposomes, and microemulsions) and penetration enhancers further enhance delivery to skin and deeper tissues. Thus, higher diclofenac concentrations do not guarantee superior

absorption than lower-concentration formulations with optimized characteristics. These findings underscore the role of formulation composition in enhancing drug solubility and permeation beyond mere concentration.[18]

The topical drug delivery system, such as emulgel (gellified emulsion), is generally used when other systems of drug administration are unsuitable [Figure 3].[19] Emulgels offer several key advantages for topical drug delivery, primarily by minimizing systemic exposure and first-pass metabolism while preventing significant drug entry into circulation. They enhance patient compliance and acceptability through their non-greasy texture, ease of application on hairy skin, and lack of residues, making them suitable for self-medication and easy termination of therapy. In addition, emulgels enable targeted delivery at the application site with superior skin penetration due to their dual hydrophilic-hydrophobic nature, providing a convenient alternative to conventional formulations.[20] Topical diclofenac is available in several different forms, including gel, spray, emulsion, aqueous solution, cream, and transdermal patch. Pradal *et al.*, demonstrated that diclofenac 1.16% emulsion achieved statistically significantly higher permeation through human skin at 24 h compared to diclofenac 5% gel. The permeated dose showed a 7-fold difference, with 0.54% for diclofenac 1.16% emulsion versus 0.077% for diclofenac 5% gel. Rheological evaluation confirmed that the 5% gel exhibited higher viscosity than the 1.16% emulsion.[18]

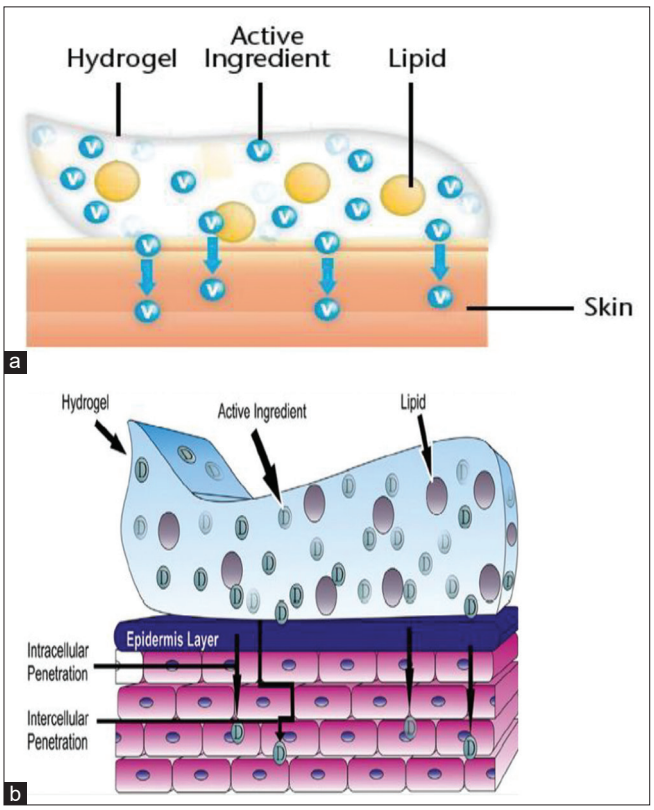

Figure 3: Overview of the structure of emulgel and penetration in the skin. A: Active ingredient penetration in skin; B. Penetration of active ingredient in the intracellular and intercellular layers of the skin.[19] (a) Adapted from Raju K *et al. World J Pharm Pharm Sci.* 2019;8(07):1179-97; (b) Adapted from Vats S *et al. Int J Pharm Res Scholars.* 2014;3(2):649-60

A key microdialysis study in 20 healthy volunteers directly measured diclofenac concentrations in superficial (3.9 ± 0.3 mm) and deep (9.3 ± 0.5 mm) tissue layers following topical application of ~300 mg/100 cm^2. Probes were calibrated *in vivo* with depths verified by 7.5 MHz ultrasound (mean interprobe distance 5.5 ± 0.7 mm). Detectable concentrations were achieved in 11/20 experiments, with comparable area under the curve (AUCs) of 532 ± 197 pg·min/mL (superficial) and 438 ± 249 pg·min/mL (deep layers), confirming ~1 cm tissue penetration. Notably, no correlation existed between probe depth and AUC ($r = 0.1$), suggesting transdermal diclofenac delivery – at least after single doses – is unpredictable and influenced by individual skin properties. These findings support topical diclofenac's ability to reach therapeutically relevant depths while highlighting the need for optimized formulations to ensure consistent penetration.[21]

Advantages of emulgels over others

Over the past two decades, topical drug delivery has emerged as a highly suitable and user-friendly method for medication administration.[22,23] Traditional semisolid preparations such as creams, gels, and lotions often suffer from drawbacks, including stickiness, poor dispersibility on skin, and formulation instability. Emulgels address these challenges effectively, particularly for hydrophobic drugs, by offering a stable and innovative topical platform. This system has attracted growing attention in recent years for enhancing drug delivery outcomes. Key benefits associated with emulgels include higher drug loading, enhanced stability, sustained release profiles, better patient adherence, and evasion of first-pass metabolism, along with GI risks.[22]

The diclofenac emulgel formulation enables efficient delivery of drugs that are hydrophobic or exhibit poor water solubility. Its analgesic and anti-inflammatory properties make it acceptable to patients. In a study by Naik *et al.*, the optimized diclofenac emulgel batch demonstrated 95.08% drug release over 48 h and maintained stability for 3 months. The optimized diclofenac emulgel (F3) displayed optimal viscosity, superior drug release, and enhanced flow properties than other formulations or commercial products. This formulation promoted greater drug permeation, higher bioavailability, and faster attainment of peak plasma levels.[24]

Guidelines for the Management of OA

Guidelines from the American College of Physicians and American Academy of Family Physicians suggest topical

NSAIDs as first-line therapy for acute pain from non-low back and musculoskeletal injuries. The American College of Rheumatology and OA Research Society International strongly recommend topical NSAIDs for patients with KOA and offer conditional recommendations for those with hand OA.[14,25] Several clinical practice guidelines are available to support clinicians in managing hip and KOA [Table 1]. Most recommend education, exercise, and weight reduction (when indicated) as first-line interventions. Despite this, fewer than 40% of patients reportedly receive guideline-based care, and many people referred for orthopedic evaluation or joint replacement have not undergone these core therapies. Barriers to implementation include inconsistencies in guideline quality and methodology, as well as variability in recommendations, which may reduce clinician confidence and hinder adherence in routine practice.[26]

METHODS

A structured questionnaire focusing on physician perceptions, practices, and preferences related to the use of topical diclofenac in the management of OA was circulated among healthcare professionals (HCPs) across India. The survey included 12 multiple-choice questions assessing aspects such as perceived potency of topical diclofenac, awareness, and acceptability of emulgel formulations, patient tolerability, and prescribing behavior. In total, 43 orthopedists participated in the survey. All participants completed the survey in full, and their responses were recorded and analyzed. The collected data were compiled in Microsoft Excel, and percentages were calculated to summarize the overall trends and preferences identified among the respondents.

Expert Opinions

The responses of the HCPs to each question are described in the following text:

Perceived Efficacy of Topical Diclofenac Gel in Clinical Practice

Most of the HCPs (60.0%) perceived topical diclofenac gel primarily as an adjunct to oral therapy for pain management. Around 28.6% considered it to provide a therapeutic effect comparable to oral NSAIDs, while 5.7% believed that it mainly offers psychological relief to patients. Another group (5.7%) expressed uncertainty regarding its overall effectiveness in pain control.

Clinician Perspectives on the Therapeutic Value of Counter-irritants (Capsaicin and Salicylate)

The majority of HCPs (57.1%) agreed that counter-irritants such as capsaicin and salicylates offer therapeutic benefits in clinical practice. In contrast, 22.9% felt these agents may be beneficial only in certain situations, whereas 20.0% disagreed, indicating that they do not provide meaningful therapeutic value in pain management.

Physician-reported Challenges in Patients Using Topical Formulations Containing Counter-irritants

In clinical practice, burning sensation was the most commonly reported issue with counter-irritant-based creams and gels, noted by 77.1% HCPs. Skin irritation was reported by 60.0%, redness by 48.6%, and severe reactions in sensitive skin by 31.4%. A small number of respondents (5.7%) indicated no associated issues [Figure 4].

Clinician Perceptions toward the Use of Emulgel Formulations

The majority of HCPs (91.4%) agreed that emulgel formulations, owing to their dual-release characteristics and enhanced skin penetration, would be suitable for use in clinical practice. In contrast, 5.7% of HCPs reported that they would not consider using this formulation, whereas 2.9% expressed conditional interest, reflecting overall strong acceptance toward emulgel as an advanced topical delivery system [Figure 5].

Table 1: Guidelines for the management of osteoarthritis[5]

Society guideline	Year	Oral NSAIDs	Topical NSAIDs
NICE	2022	If topical medicines are ineffective or unsuitable	First-line therapy
OARSI	2019	Conditionally recommended	Strongly recommended
Choosing Wisely Canada	2023	Strongly recommended	Strongly recommended
AAOS	2022	Appropriate	Appropriate
Royal Australian College of General practitioners	2018	Conditionally recommended	Conditionally (neutral) recommended

NICE: National Institute for Health and Care Excellence, OARSI: Osteoarthritis Research Society International, AAOS: American Academy of Orthopaedic Surgeons, NSAIDs: Non-steroidal anti-inflammatory drugs. Adapted from Shtroblia V *et al. Front Med.* 2025;12:1523027

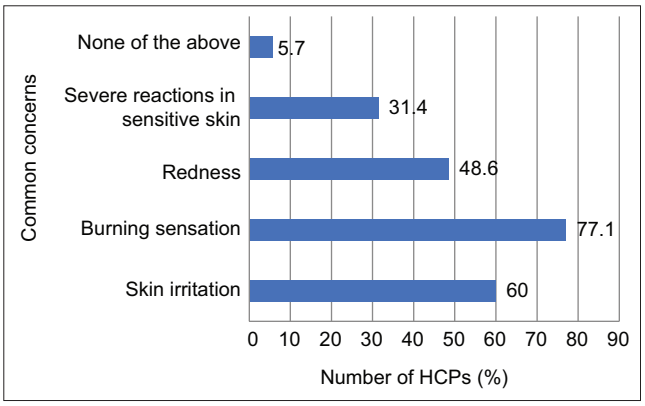

Figure 4: Common concerns with counter-irritant creams/gels

Clinician Views on the Aesthetic Advantages of Topical Gels

Around 74.3% of HCPs identified non-staining property as the most valuable aesthetic advantage of topical gels, followed closely by the non-greasy nature, rated extremely important by 71.4% of respondents. Ease of removal was also considered important by 54.3% of HCPs, while the pleasing appearance of the formulation showed relatively greater variation, with 48.6% rating it as extremely important. Several clinicians additionally highlighted attributes such as a cooling sensation, odorless nature, improved patient compliance, soothing and non-irritating effects, effective pain relief, and reduced GI discomfort, reflecting broad appreciation of both the functional and aesthetic advantages of topical gel formulations [Figure 6].

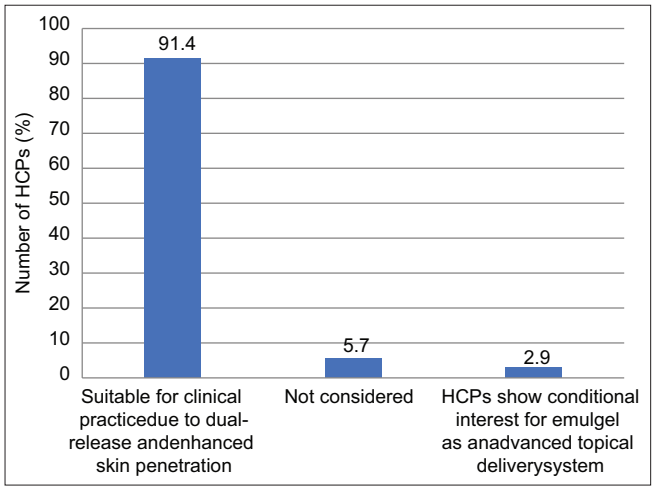

Figure 5: Clinician perceptions toward the use of emulgel formulations

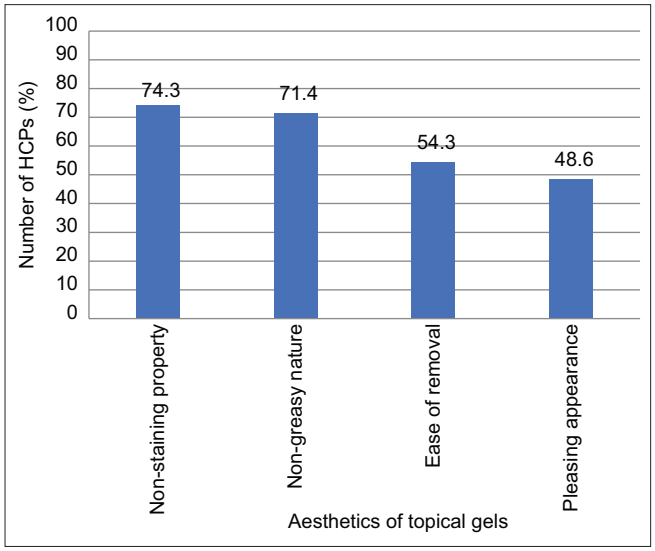

Figure 6: Clinicians' view on aesthetic advantages of topical gels

Attributes of Topical Gels Associated with Enhanced Patient Outcomes

From clinical experience, enhanced drug penetration was the most influential factor for improving patient outcomes, selected by 80.0% of HCPs. This was followed by a non-irritating profile selected by (62.9%) and good spreadability by (57.1%). Better cosmetic acceptability and a greaseless formulation were each highlighted by 51.4%, whereas hot/cold sensation was considered beneficial by 20%. A small number of respondents additionally cited pleasant aroma and easy/early absorption (2.9% each) as contributing to improved patient outcomes [Figure 7].

Clinician Preference for Diclofenac Emulgel Based on its Formulation Advantages

Most of the HCPs (65.7%) reported an extremely high likelihood (scores 9–10) of prescribing diclofenac emulgel for joint pain, reflecting a strong preference for this formulation. Around 22.9% indicated that they were very likely (scores 7–8) to prescribe it, whereas 11.4% reported being only somewhat likely (scores 4–6) [Figure 8].

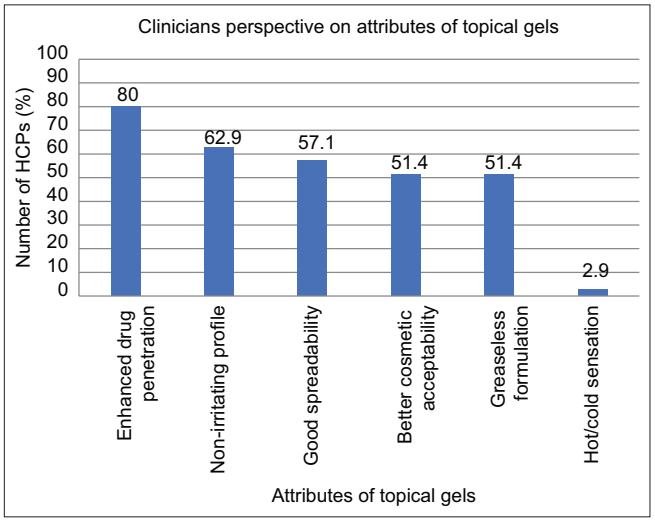

Figure 7: Attributes of topical gels

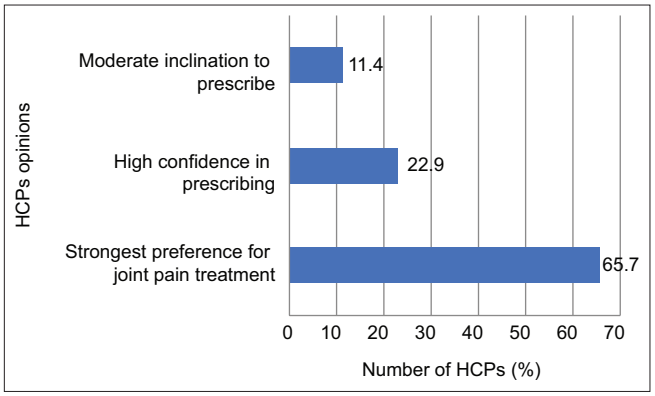

Figure 8: Clinician preference for prescribing diclofenac emulgel in osteoarthritis

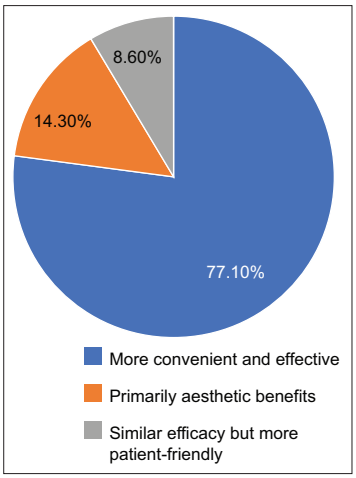

Figure 9: Clinician perceptions of emulgel formulations vs. conventional topical gels

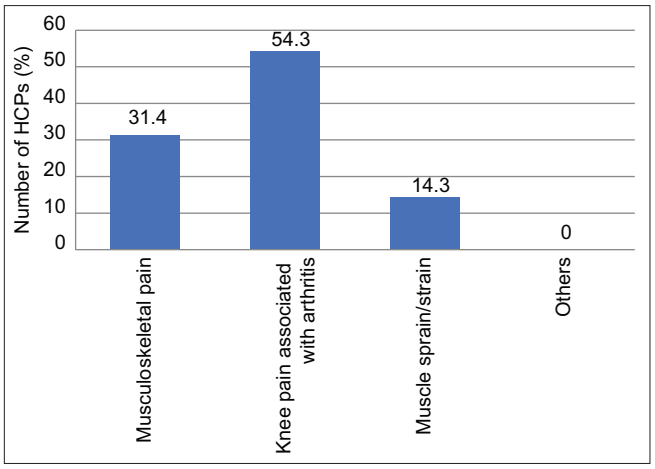

Figure 10: Common indications for topical non-steroidal anti-inflammatory drug gels

Key Attributes Driving Topical NSAID Preference among Working Professionals

Among working professionals, quick absorption without residue emerged as the top feature improving topical NSAID acceptability, preferred by 68.6% of HCPs. Non-greasy texture ranked second (preferred by 62.9%), followed by non-irritating characteristics (54.3%) and odorless application (51.4%).

Clinician Perceptions of Emulgel Formulations Compared to Conventional Topical Gels

The majority of HCPs (77.1%) perceived emulgel formulations as more convenient and effective than conventional topical gels. This was followed by 14.3% who viewed them primarily as offering aesthetic benefits and 8.6% who considered them similar in efficacy but more patient-friendly [Figure 9].

Clinical Practice Patterns in Following Guideline-recommended Use of Topical NSAIDs for OA

Around 57.1% of HCPs always followed guideline-recommended first-line use of topical NSAID gels in OA management, whereas 31.4% applied this approach in most cases. Occasional use was reported by 11.4% of respondents, with no HCPs indicating rare or never using topical NSAIDs as first-line therapy.

Clinical Indications for the Use of Topical NSAID Gels in Routine Practice

In clinical practice, topical NSAID gels were most commonly recommended by 54.3% of HCPs for knee pain associated with arthritis. 31.4% of HCPs prefer it for the management of musculoskeletal pain, and 14.3% of HCPs for muscle sprain or strain [Figure 10].

Clinicians' Perspectives on the Safe Duration of Topical Diclofenac Therapy

In clinical practice, the majority of HCPs (40.0%) considered 1–2 months as a safe duration for prescribing topical diclofenac. In addition, 28.6% of HCPs preferred a duration of around 3 months, 14.3% selected up to 1 year, 11.4% chose more than 6 months, and 5.7% opted for <1 week.

CONCLUSION

Topical diclofenac (emulgel) is first-line OA pain therapy, backed by National Institute for Health and Care Excellence/Osteoarthritis Research Society International (NICE/OARSI) guidelines, clinical evidence, and clinician support – offering superior viscosity, bioavailability, and adherence while minimizing systemic risks.

Clinical Evidence Summary

Meta-analyses confirm topical diclofenac delivers pain relief and functional gains comparable to oral NSAIDs but superior to paracetamol, with markedly lower GI, hepatic and CV risks – primarily limited to mild local skin reactions.

Advanced Formulations

Emulgel variants offer superior viscosity, release profiles, stability, and bioavailability over conventional topicals, addressing common issues such as poor spreadability while enhancing patient adherence.

Real-World Insights

Among 42 surveyed Indian HCPs, over 90% favor emulgels for their penetration and aesthetics. About 57% routinely prescribe topical NSAIDs first-line for KOA and musculoskeletal pain, viewing them as safe for 1–3 months.

Forward Perspective

Prioritizing topical diclofenac, especially emulgels, aligns with guidelines (NICE, OARSI) and bridges evidence-practice gaps to optimize OA outcomes and minimize systemic risks.

ACKNOWLEDGMENT

We would like to acknowledge Scientimed Solutions Pvt. Ltd. for assistance in developing the manuscript.

REFERENCES

1. Rafanan BS, Valdecañas BF, Lim BP, Malairungsakul A, Tassanawipas W, Shiyi C, *et al*. Consensus recommendations for managing osteoarthritic pain with topical NSAIDs in Asia-Pacific. Pain Manag 2018;8:115-28.
2. Jindal A, Krishna G, Ilavarasan S, Acharya K, Kishore KM, Kumar P, *et al*. Real-world clinical experience with freeflex™ emulgel in osteoarthritis: Insights from a cross-sectional survey of orthopedician specialists. Int J Orthop Sci 2025;11:87-91.
3. McMahon SB, Dargan P, Lanas A, Wiffen P. The burden of musculoskeletal pain and the role of topical non-steroidal anti-inflammatory drugs (NSAIDs) in its treatment. Ten underpinning statements from a global pain faculty. Curr Med Res Opin 2021;37:287-92.
4. Mason L, Moore RA, Derry S, Edwards JE, McQuay HJ. Systematic review of topical capsaicin for the treatment of chronic pain. BMJ 2004;328:991.
5. Shtroblia V, Petakh P, Kamyshna I, Halabitska I, Kamyshnyi O. Recent advances in the management of knee osteoarthritis: A narrative review. Front Med (Lausanne) 2025;12:1523027.
6. Bariguian Revel F, Fayet M, Hagen M. Topical diclofenac, an efficacious treatment for osteoarthritis: A narrative review. Rheumatol Ther 2020;7:217-36.
7. Altman RD, Barthel HR. Topical therapies for osteoarthritis. Drugs 2011;71:1259-79.
8. Singh V, Devi M, Verma KK. A review article on diclofenac sodium topical gel on osteoarthritis. Res J Top Cosmet Sci 2024;15:53-9.
9. Alfaro RA, Davis DD. Diclofenac. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2025. Available from: https://www.ncbi.nlm.nih.gov/books/NBK557879 [Last accessed on 2025 Dec 22].
10. Hagen M, Baker M. Skin penetration and tissue permeation after topical administration of diclofenac. Curr Med Res Opin 2017;33:1623-34.
11. Wang Y, Fan M, Wang H, You Y, Wei C, Liu M, *et al*. Relative safety and efficacy of topical and oral NSAIDs in the treatment of osteoarthritis: A systematic review and meta-analysis. Medicine (Baltimore) 2022;101:e30354.
12. Sisignano M, Rice AS, Geisslinger G. Topical analgesics: Pharmacology and clinical applications. Anesthesiology 2025;143:1371-81.
13. Bihlet AR, Byrjalsen I, Simon LS, Carrara D, Delpy L, Derne C, *et al*. A novel diclofenac gel (AMZ001) applied once or twice daily in subjects with painful knee osteoarthritis: A randomized, placebo-controlled clinical trial. Semin Arthritis Rheum 2020;50:1203-13.
14. Sicignano NM, Revel FB, Petruschke R, Barbone FP, Nicholson K, Edison JD, *et al*. Evaluating the real-world use of topical diclofenac sodium gel 1% using US longitudinal electronic health records database: A study supporting OTC switch. Pain Therapy 2025;14:1007-24.
15. Chen Z, Chen B, Li P, Feng K. Efficacy and safety of different topical Diclofenac formulations for the treatment of knee osteoarthritis: A meta-analysis of short-term and long-term treatment comparisons. BMC Musculoskelet Disord 2025;26:230.
16. Nair B, Taylor-Gjevre R. A review of topical Diclofenac use in musculoskeletal disease. Pharmaceuticals (Basel) 2010;3:1892-908.
17. Niethard FU, Gold MS, Solomon GS, Liu JM, Unkauf M, Albrecht HH. Efficacy of topical diclofenac diethylamine gel in osteoarthritis of the knee. J Rheumatol 2005;32:2384-92.
18. Pradal J, Vallet CM, Frappin G, Bariguian F, Lombardi MS. Importance of the formulation in the skin delivery of topical diclofenac: Not all topical diclofenac formulations are the same. J Pain Res 2019:1149-54.
19. Raju K, Sneha G, Khatoon R, Sneha G, Khatoon R, Ashwini M, *et al*. Formulation and evaluation of ornidazole topical emulgel. World J Pharm Pharm Sci 2019;8:1179-97.
20. Vats S, Saxena C, Easwari TS, Shukla VK. Emulsion-based gel technique: Novel approach for enhancing topical drug delivery of hydrophobic drugs. Int J Pharm Res Sch 2014;3:649-60.
21. Müller M, Mascher H, Kikuta C, Schäfer S, Brunner M, Dorner G, *et al*. Diclofenac concentrations in defined tissue layers after topical administration. Clin Pharmacol Ther 1997;62:293-9.
22. Jha S, Singh P, Yadav K, Rai A, Chouhan M. Formulation and development of diclofenac topical emulgels. J Chem Health Risks 2024;14:2274-80.
23. Talat M, Zaman M, Khan R, Jamshaid M, Akhtar M, Mirza AZ, *et al*. Emulgel: An effective drug delivery system. Drug Dev Ind Pharm 2021;47:1193-9.
24. Naik DC, Mahammed SN, Samreen M, Vamsi S, Hemalatha P. Formulation and evaluation of Diclofenac emulgel using natural permeation enhancers. J Appl Pharm Res 2025;13:108-14.
25. Altman RD, Dreiser RL, Fisher CL, Chase WF, Dreher DS, Zacher J. Diclofenac sodium gel in patients with primary hand osteoarthritis: A randomized, double-blind, placebo-controlled trial. J Rheumatol 2009;36:1991-9.
26. Gibbs AJ, Gray B, Wallis JA, Taylor NF, Kemp JL, Hunter DJ, *et al*. Recommendations for the management of hip and knee osteoarthritis: A systematic review of clinical practice guidelines. Osteoarthr Cartil 2023;31:1280-92.

How to cite this article: Kalra R, Jalan D, Verma SK, Jain N. Optimizing Topical Diclofenac Emulgel Therapy in Osteoarthritis: Insights from Clinical Practice in India. Int J Sci Stud 2026;13(10):9-16.

Source of Support: Nil, **Conflicts of Interest:** None declared.