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ORIGINAL RESEARCH

Topical Application of Dipyridamole and Roflumilast Combination Nanoparticles Loaded Nanoemulgel for the Treatment of Psoriasis in Rats

Abstract

Background: Phosphodiesterase-4 is an enzyme that regulates immune responses and contributes to the development of psoriasis. Dipyridamole and roflumilast function as phosphodiesterase-4 inhibitors, reducing pro-inflammatory cytokine expression. The aim was to evaluate the anti-psoriatic effect of the topical administration of dipyridamole and roflumilast nanoemulgel combination on imiquimod-induced psoriasiform skin inflammation in rats.
Methods: Dipyridamole and roflumilast were formulated into nanoemulgel to enhance skin penetration and retention. The production of nanoemulgels involves a two-part process. A nanoemulsion is created (the aqueous phase titration method was employed to create nanoemulsions), which is then incorporated into the gelling agent during the second phase. The new formula was then tested in rats. The rats were divided into seven groups; all animals were treated for 16 days. Induction was achieved by 120 mg of 5% imiquimod cream, which was applied daily for 8 days. After induction, groups received one of the following: 0.05% clobetasol ointment, 1% dipyridamole nanoemulgel (D-NEG), 0.3% roflumilast nanoemulgel (R-NEG), 1% dipyridamole and 0.3% roflumilast gel combination (DR-gel), and 1% dipyridamole and 0.3% roflumilast nanoemulgel combination (DR-NEG). At the end of the experiment, all animals were euthanized, and their blood and skin tissue samples were obtained. Inflammatory markers, immunohistochemistry, and histopathology were measured.

Results: The DR-NEG group showed significantly lower levels of IL17, IL23, and TNF-α, while TGF-β showed higher levels than the clobetasol group. The expression of CK16 was significantly lower compared to the clobetasol group. DR-NEG showed a significantly lower PASI and Baker score than the clobetasol group.

Conclusion: The new DR-NEG's topical combination administration showed better anti-inflammatory, tissue healing, and anti-psoriatic activity than each drug alone or topical clobetasol administration; this could be attributed to the possible synergic effects of both drugs and the enhanced skin penetration offered by the nanoemulgel formulation