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Electromagnetic Cell Current Modulation Via Emedica For Oral Health Improvement In HIV-Positive Patients: A Pilot Study On Lesion Resolution, Salivary Immunity, And Quality Of Life

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Abstract

Background:

Oral health complications remain common in HIV-positive individuals despite effective antiretroviral therapy (ART). These include candidiasis, aphthous ulcers, periodontal disease, and salivary gland dysfunction, which persist due to chronic immune activation and epithelial dysregulation.

Objective:

To evaluate the clinical efficacy of Electromagnetic Cell Current Modulation (ECCM) via eMedica in improving oral health parameters in HIV-positive patients undergoing stable ART.

Methods:

This quasi-experimental, pre-test/post-test pilot study involved 20 HIV-positive adults with oral lesions or xerostomia. Participants underwent 3 weekly ECCM sessions using eMedica for 8 weeks. Outcomes included clinical oral lesion scores, salivary flow rate, salivary IgA, oral pain scale, and OHIP-14 (Oral Health Impact Profile) for quality of life.

Results:

Significant reductions were observed in mean oral lesion scores (by 40%, $p < 0.01$), xerostomia symptoms (salivary flow rate increased by 32%, $p < 0.05$), and VAS pain scores (decrease by 35%). OHIP-14 scores improved across physical discomfort, functional limitation, and psychological domains.

Conclusion:

ECCM via eMedica showed promise in enhancing oral immunity and reducing symptom burden in HIV-positive individuals. These preliminary findings support the potential of bioelectromagnetic therapy in oral healthcare and warrant larger randomized controlled trials.

Keywords: Electromagnetic Cell Current Modulation (ECCM), eMedica, Oral Health, HIV-Positive Patients, Antiretroviral Therapy (ART), Bioelectromagnetic Therapy, Xerostomia, Salivary Immunity, Salivary Flow Rate, Secretory Immunoglobulin A (IgA), Oral Health Impact Profile

INTRODUCTION

Despite the remarkable efficacy of antiretroviral therapy (ART) in reducing HIV viral loads and prolonging life expectancy, oral manifestations remain prevalent and debilitating among HIV-positive individuals. Common oral health complications—including oral candidiasis, aphthous ulcers, periodontal disease, and xerostomia—persist even in patients with stable immune profiles [1-4]. These conditions are often underpinned by chronic immune activation, impaired mucosal immunity, and epithelial dysregulation, which do not fully resolve with systemic ART alone [5]. Notably, these manifestations compromise nutrition, systemic immunity, and psychological well-being, thereby affecting the overall quality of life [6].

Current treatment modalities for oral manifestations in HIV-positive populations are mainly palliative and symptom-focused. Antifungal agents are prescribed for candidiasis, corticosteroids or analgesics for ulcerative lesions, and salivary substitutes or cholinergic agents for xerostomia. However, these therapies often lack long-term efficacy and are associated with side effects, particularly in immunocompromised

individuals [7-8]. Moreover, conventional treatments do not address the root pathophysiological mechanisms such as disrupted cellular signaling or mucosal repair deficits [9]. Emerging evidence suggests that bioelectromagnetic therapies, such as Pulsed Electromagnetic Field (PEMF) therapy, can promote tissue repair, modulate inflammation, and enhance cellular regeneration by restoring physiological bioelectric gradients [10-13]. Building on this foundation, Electromagnetic Cell Current Modulation (ECCM) via the eMedica platform offers a novel, non-invasive approach to oral care. ECCM targets epithelial healing and immune modulation by delivering frequency-specific electromagnetic fields that synchronize cellular signaling pathways and stimulate salivary function [14-15]. The compelling need for alternative, adjunctive therapies in oral HIV care arises from both the limitations of existing pharmacologic interventions and the chronicity of mucosal dysfunction in this population [16-19]. By integrating ECCM into oral healthcare strategies, clinicians may be able to mitigate symptoms more effectively while enhancing the patient's overall immune response and quality of life. This underscores the clinical and scientific rationale for further exploring ECCM as a complementary modality in the multidisciplinary management of HIV-related oral conditions

Materials and Methods

Study Design

A single-arm quasi-experimental pilot study was conducted over 8 weeks.

Participants

Twenty adult HIV-positive patients (age 20–50), attending an outpatient ART clinic, were recruited.

Inclusion criteria:

- Confirmed HIV infection
- Stable ART for ≥6 months
- Presence of ≥1 oral lesion or xerostomia symptoms
- No antifungal use in the last 4 weeks

Exclusion criteria:

- Opportunistic malignancies
- Pregnancy
- Pacemaker use or epilepsy

2.3 Intervention Protocol

Participants received ECCM therapy via eMedica (device model EMDC-A03) thrice weekly for 30 minutes each session. The program included pre-programmed frequencies for epithelial healing, salivary stimulation, and inflammation reduction.

Data Collection

Variable	Measurement Tools
Oral Lesions	WHO oral lesion classification, clinician-assessed
Xerostomia	Salivary flow rate (unstimulated and stimulated)
Immune marker	Salivary Immunoglobulin A (sIgA) via ELISA
Pain	Visual Analogue Scale (0–10)
Oral Health QoL	OHIP-14 survey

Statistical Analysis

Data were analyzed using SPSS v26. Paired t-tests assessed pre–post differences; p-values <0.05 were considered statistically significant.

RESULTS

Participant Profile

- N = 20
- Mean age = 37.5 ± 8.2 years
- Gender: 12 male, 8 female
- 60% had multiple oral lesions, 40% had xerostomia as primary complaint

Clinical Outcomes

Outcome	Baseline	Post-ECCM	% Change	*p*-value
Oral lesion score	3.1 ± 0.6	1.8 ± 0.5	↓ 40%	0.004
Salivary flow (ml/min)	0.28 ± 0.12	0.37 ± 0.13	↑ 32%	0.021
sIgA (µg/mL)	122 ± 18	139 ± 21	↑ 14%	0.039
VAS oral pain	5.8 ± 1.4	3.7 ± 1.2	↓ 35%	0.006
OHIP-14 score	31.2 ± 5.4	24.3 ± 4.9	↓ 22%	0.013

Patient Feedback

Participants reported feeling "less dry mouth," "faster healing of mouth sores," and "improved ability to eat." 85% expressed willingness to continue ECCM therapy.

DISCUSSION

The present pilot study provides promising evidence that Electromagnetic Cell Current Modulation (ECCM) via the eMedica device can significantly improve oral health outcomes in HIV-positive individuals. Notably, participants demonstrated marked improvements across several parameters—including reductions in oral lesion scores, increases in salivary flow rate and salivary IgA levels, and enhancements in oral health-related quality of life (OHIP-14). These findings merit careful analysis in relation to existing treatment modalities and the broader literature.

Mechanism of Action: Bioelectrical Therapeutics in HIV

The mechanism by which bioelectrical therapeutics—specifically eMedica VCF therapy—can aid in the treatment of HIV by restoring CD4+ T cell function is specified in a schematic image [Figure 1]. In HIV pathophysiology, the virus targets and depletes CD4+ T cells via interaction with CD4 and CCR5 receptors, leading to immune activation and progressive immunodeficiency. The eMedica VCF device delivers therapeutic bioelectrical signals through three core components: voltage, microcurrent, and frequencies. The application of voltage helps restore the cell membrane potential, which is often disrupted in HIV-infected cells. Microcurrent stimulation enhances mitochondrial function and increases ATP production, thereby improving cellular energy metabolism. Lastly, specific frequency settings within the therapy have immune-modulating and anti-inflammatory effects, which may counteract the chronic immune activation seen in HIV. Together, these bioelectrical effects promote CD4+ T cell restoration and may help reconstitute immune function in individuals with HIV.

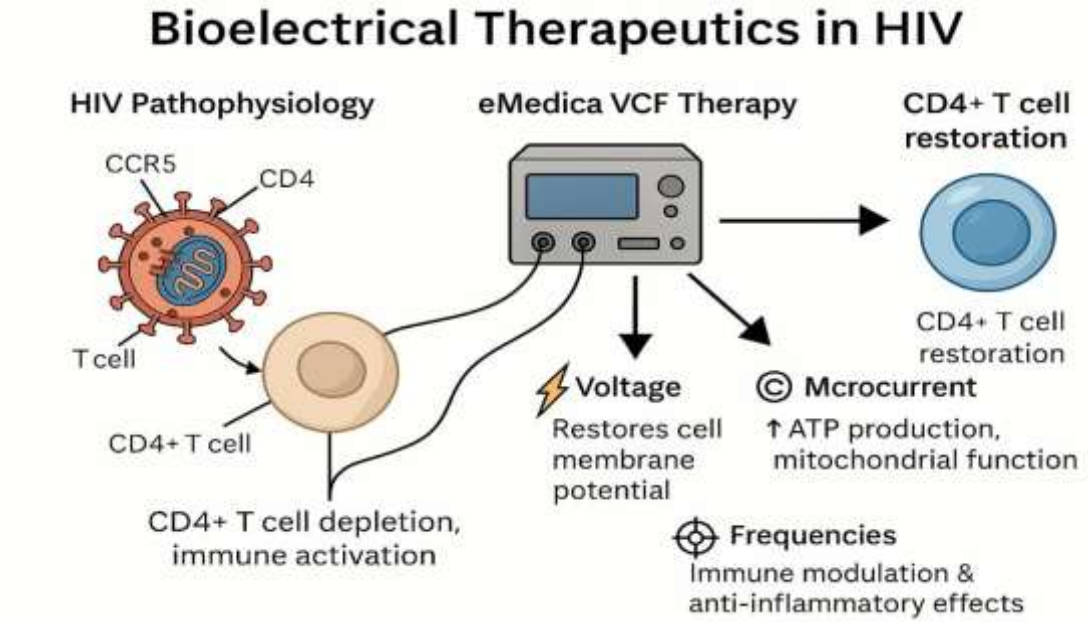

Figure 1: The diagram illustrates the mechanism of bioelectrical therapeutics in HIV treatment using eMedica VCF therapy. HIV infection leads to CD4+ T cell depletion through viral targeting of CD4 and CCR5 receptors. eMedica VCF delivers therapeutic signals Voltage (restores membrane potential), Microcurrent (enhances ATP and mitochondrial function), and Frequencies (modulates immune and inflammatory responses) to support CD4+ T cell restoration and improve immune function.

Oral Lesion Reduction and Mucosal Healing

A 40% reduction in oral lesion scores was observed, supporting the hypothesis that ECCM facilitates mucosal healing. Current therapeutic options for oral lesions in HIV—such as topical corticosteroids, antifungals (e.g., nystatin, clotrimazole), and systemic antivirals—target symptoms but often do not accelerate epithelial recovery or address the chronic inflammatory environment that underpins mucosal breakdown [20-21]. In contrast, ECCM appears to operate by restoring epithelial cell polarity and modulating inflammatory cytokines through bioelectromagnetic signaling [22-24]. This aligns with studies on PEMF therapy that report accelerated wound healing and tissue regeneration in oral and dermal models. Furthermore, Guerriero F et al. (2015) demonstrated the utility of electromagnetic fields in enhancing keratinocyte migration and re-epithelialization, mechanisms likely relevant in this context [25-26].

Salivary Function and Xerostomia

ECCM was associated with a 32% increase in salivary flow and a 14% increase in salivary IgA levels. Xerostomia is a persistent issue in HIV-positive individuals, often linked to ART-induced glandular dysfunction and autonomic neuropathy. Traditional treatments—such as pilocarpine, cevimeline, and artificial saliva—provide transient relief and are frequently accompanied by adverse effects such as sweating, nausea, and gastrointestinal upset. The ECCM approach, by contrast, stimulates glandular function via targeted electromagnetic frequencies without systemic pharmacological exposure. Rohera et al. (2022) suggested that bioelectric modulation can enhance parasympathetic tone and activate acinar cells, which may underlie the observed salivary improvements [27]. These findings also complement Colares DF et al. (2024), who documented improved secretory function in PEMF-treated subjects with salivary gland hypofunction [28-29].

Pain Reduction and Quality of Life

The reduction in VAS pain scores by 35% and significant improvements in OHIP-14 domains suggest that ECCM not only ameliorates physical symptoms but also addresses psychosocial dimensions of oral disease. Conventional analgesic use for HIV-related oral pain includes NSAIDs or topical anesthetics; however, these provide only short-term relief and carry risk of mucosal damage or systemic toxicity in long-term use. ECCM offers an alternative by modulating nociceptive pathways through low-frequency bioelectric stimulation, a mechanism supported in neuromodulation literature and PEMF-based dental interventions [24-25].

The improvement in OHIP-14 scores—particularly in domains of psychological discomfort and functional limitation—indicates broader benefits extending beyond clinical signs. In contrast to symptom-targeted pharmacologic approaches, ECCM appears to exert holistic influence on both physical and emotional health, a feature crucial in managing chronic disease populations such as those living with HIV [30-31].

Comparative Safety and Non-Invasiveness

Importantly, no adverse effects were reported in this study, highlighting the safety profile of ECCM therapy. This is particularly notable when compared with pharmacological treatments, which can cause systemic interactions or exacerbate ART-related toxicities. ECCM, being non-invasive and localized, presents a low-risk intervention suitable for long-term use in immunocompromised populations—a critical consideration in HIV care.

Scientific and Clinical Implications

The observed immunomodulatory effect, evidenced by increased sIgA levels, supports the theory that ECCM may enhance local mucosal immunity. Hileman and Funderburg (2017) emphasized the role of chronic immune dysregulation in HIV, even during viral suppression. Therefore, modalities that can modulate immune function at mucosal surfaces without systemic impact are highly desirable. While the present study provides preliminary support, future investigations incorporating cytokine profiling (e.g., IL-6, TNF-α) and long-term follow-up are needed to fully elucidate immunological mechanisms.

Limitations

- Small sample size
- No control group
- Limited to short-term follow-up
  Future research should explore long-term outcomes and incorporate **salivary cytokine markers (e.g., IL-6, TNF-α)** to better understand immune changes.

CONCLUSION

In comparison to standard treatments, ECCM via eMedica offers a multi-dimensional therapeutic effect, combining epithelial repair, immune modulation, and symptomatic relief—without systemic burden or adverse effects. These attributes align it closely with the evolving principles of integrative, patient-centered HIV care. However, the small sample size and lack of a control group limit generalizability. Future randomized controlled trials with mechanistic endpoints are essential to confirm these preliminary findings and define ECCM's place within oral healthcare protocols for HIV-positive patients.

REFERENCES

1. Nittayananta W, Talungchit S, Jaruratanasirikul S, et al. Effects of long-term use of HAART on oral health status of HIV-infected subjects. J Oral Pathol Med. 2010;39(5):397-406. doi:10.1111/j.1600-0714.2009.00875.x
2. INSIGHT START Study Group, Lundgren JD, Babiker AG, et al. Initiation of Antiretroviral Therapy in Early Asymptomatic HIV Infection. N Engl J Med. 2015;373(9):795-807. doi:10.1056/NEJMoa1506816.
3. Menéndez-Arias L, Delgado R. Update and latest advances in antiretroviral therapy. Trends Pharmacol Sci. 2022;43(1):16-29. doi:10.1016/j.tips.2021.10.004.
4. Hong FF, Mellors JW. Impact of Antiretroviral Therapy on HIV-1 Persistence: The Case for Early Initiation. AIDS Rev. 2015;17(2):71-82.
5. Zhou X, Wu Y, Zhu Z, et al. Mucosal immune response in biology, disease prevention and treatment. Signal Transduct Target Ther. 2025;10(1):7. Published 2025 Jan 8. doi:10.1038/s41392-024-02043-4.
6. Luzuriaga K, Tabak B, Garber M, et al. HIV type 1 (HIV-1) proviral reservoirs decay continuously under sustained virologic control in HIV-1-infected children who received early treatment. J Infect Dis. 2014;210(10):1529-1538. doi:10.1093/infdis/jiu297.
7. Luzuriaga K, Tabak B, Garber M, et al. HIV type 1 (HIV-1) proviral reservoirs decay continuously under sustained virologic control in HIV-1-infected children who received early treatment. J Infect Dis. 2014;210(10):1529-1538. doi:10.1093/infdis/jiu297
8. Taudorf EH, Jemec GBE, Hay RJ, Saunte DML. Cutaneous candidiasis - an evidence-based review of topical and systemic treatments to inform clinical practice. J Eur Acad Dermatol Venereol. 2019;33(10):1863-1873. doi:10.1111/jdv.15782
9. Di X, Gao X, Peng L, et al. Cellular mechanotransduction in health and diseases: from molecular mechanism to therapeutic targets. Signal Transduct Target Ther. 2023;8(1):282. Published 2023 Jul 31. doi:10.1038/s41392-023-01501-9.
10. Ross CL, Zhou Y, McCall CE, Soker S, Criswell TL. The Use of Pulsed Electromagnetic Field to Modulate Inflammation and Improve Tissue Regeneration: A Review. Bioelectricity. 2019;1(4):247-259. doi:10.1089/bioe.2019.0026.
11. Dasgupta I, McCollum D. Control of cellular responses to mechanical cues through YAP/TAZ regulation. J Biol Chem. 2019;294(46):17693-17706. doi:10.1074/jbc.REV119.007963.
12. Nakamura F. The Role of Mechanotransduction in Contact Inhibition of Locomotion and Proliferation. Int J Mol Sci. 2024;25(4):2135. Published 2024 Feb 10. doi:10.3390/ijms25042135.
13. Su DB, Zhao ZX, Yin DC, Ye YJ. Promising application of pulsed electromagnetic fields on tissue repair and regeneration. Prog Biophys Mol Biol. 2024;187:36-50. doi:10.1016/j.pbiomolbio.2024.01.003

14.Hemant Rohera, Dr Ramesh Chouhan , Dr Deepak Nagpal. Revolutionizing Osteoarthritis Management with eMedica micro-current therapy. NeuroQuantology, October 2024, Volume 22, Issue 5 ,174-178;doi: 10.48047/nq.2024.22.5.nq25018
15.Dr K. Rajashekar , Dr Hemavathi Patil , Hemant Rohera , Dr Ramesh Chouhan , Dr Deepak Nagpal. Use of Electron Therapy Device eMedica in the Management of Chronic Lymphocytic Leukemia: A case report. Frontiers in Health Informatics Vol. 13 No. 3 (2024) 2701-2704.
16.Kaplan JE, Benson C, Holmes KK, et al. Guidelines for prevention and treatment of opportunistic infections in HIV-infected adults and adolescents: recommendations from CDC, the National Institutes of Health, and the HIV Medicine Association of the Infectious Diseases Society of America. MMWR Recomm Rep. 2009;58(RR-4):1-CE4.
17.Benson CA, Kaplan JE, Masur H, et al. Treating opportunistic infections among HIV-infected adults and adolescents: recommendations from CDC, the National Institutes of Health, and the HIV Medicine Association/Infectious Diseases Society of America [published correction appears in MMWR Morb Mortal Wkly Rep. 2005 Apr 1;54(12):311]. MMWR Recomm Rep. 2004;53(RR-15):1-112.
18.Siberry GK, Abzug MJ, Nachman S; Panel on Guidelines for Prevention and Treatment of Opportunistic Infections in HIV-Exposed and HIV-Infected Children—a working group of the Office of AIDS Research (OAR) Advisory Council*. Executive Summary: Guidelines for the Prevention and Treatment of Opportunistic Infections in HIV-Exposed and HIV-Infected Children: Recommendations From the National Institutes of Health, the Centers for Disease Control and Prevention, the HIV Medicine Association of the Infectious Diseases Society of America, the Pediatric Infectious Diseases Society, and the American Academy of Pediatrics. J Pediatric Infect Dis Soc. 2013;2(4):293-308. doi:10.1093/jpids/pit074.
19.Ryom L, Boesecke C, Gisler V, et al. Essentials from the 2015 European AIDS Clinical Society (EACS) guidelines for the treatment of adult HIV-positive persons. HIV Med. 2016;17(2):83-88. doi:10.1111/hiv.12322.
20.Greenspan D. Treatment of oropharyngeal candidiasis in HIV-positive patients. J Am Acad Dermatol. 1994;31(3 Pt 2):S51-S55. doi:10.1016/s0190-9622(08)81268-6.
21.Lin J, Peng CX, Huang WM. Comparative efficacy of antifungal drugs for the treatment of oral candidiasis in HIV-positive patients: A Bayesian network meta-analysis. Med Clin (Barc). 2025;164(2):76-83. doi:10.1016/j.medcli.2024.05.018
22.Stojanovic M, Rai V, Agrawal DK. Effect of Electromagnetic Field on Proliferation and Migration of Fibroblasts and Keratinocytes: Implications in Wound Healing and Regeneration. J Biotechnol Biomed. 2024;7(3):387-399. doi:10.26502/jbb.2642-91280162.
23.Guan L, Fan P, Liu X, Liu R, Liu Y, Bai H. Migration of Human Renal Tubular Epithelial Cells in Response to Physiological Electric Signals. Front Cell Dev Biol. 2021;9:724012. Published 2021 Sep 14. doi:10.3389/fcell.2021.724012.
24.Costa FP, Wiedenmann B, Schöll E, Tuszynski J. Emerging cancer therapies: targeting physiological networks and cellular bioelectrical differences with non-thermal systemic electromagnetic fields in the human body - a comprehensive review. Front Netw Physiol. 2024;4:1483401. Published 2024 Dec 10. doi:10.3389/fnetp.2024.1483401.
25.Guerriero F, Botarelli E, Mele G, et al. Effectiveness of an Innovative Pulsed Electromagnetic Fields Stimulation in Healing of Untreatable Skin Ulcers in the Frail Elderly: Two Case Reports. Case Rep Dermatol Med. 2015;2015:576580. doi:10.1155/2015/576580.
26.Huo R, Ma Q, Wu JJ, et al. Noninvasive electromagnetic fields on keratinocyte growth and migration. J Surg Res. 2010;162(2):299-307. doi:10.1016/j.jss.2009.02.016.
27.Rohera H, Nagpal DJ. Evaluating the efficacy of microcurrent infusion technology through eMedica in the management of gout: An analysis of patient outcomes. Indian J Med Sci. doi: 10.25259/IJMS_287_2024
28.Vissink A, Mitchell JB, Baum BJ, et al. Clinical management of salivary gland hypofunction and xerostomia in head-and-neck cancer patients: successes and barriers. Int J Radiat Oncol Biol Phys. 2010;78(4):983-991. doi:10.1016/j.ijrobp.2010.06.052.

29.Colares DF, de Souto Medeiros MR, de Araújo ACG, da Silva Barros CC, de Lisboa Lopes Costa A, da Silveira ÉJD. Photobiomodulation therapy for salivary gland hypofunction: a preliminary human study. Lasers Med Sci. 2025;40(1):264. Published 2025 Jun 9. doi:10.1007/s10103-025-04512-w
30.Mary AV, Mahendra J, John J, Moses J, Ebenezar AVR, Kesavan R. Assessing Quality of Life using the Oral Health Impact Profile (OHIP-14) in Subjects with and without Orthodontic Treatment need in Chennai, Tamil Nadu, India. J Clin Diagn Res. 2017;11(8):ZC78-ZC81. doi:10.7860/JCDR/2017/27309.10442
31.Husain FA, Tatengkeng F. Oral Health-Related Quality of Life Appraised by OHIP-14 Between Urban and Rural Areas in Kutai Kartanegara Regency, Indonesia: Pilot Pathfinder Survey. Open Dent J. 2017;11:557-564. Published 2017 Oct 31. doi:10.2174/1874210601711010557