ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 8, Issue – 3, June - 2025, Page No.: 92 – 102

A Comparative Study of Efficacy and Safety of Intralesional Injections of Vitamin D3, MMR Vaccine and Acyclovir in Management of Cutaneous Warts

[1]Dr. Nupur Priya, Saraswathi Institute of Medical Sciences, Hapur.

[2]Dr. Sachin Agarwal, Professor and Head, NCR Institute of Medical Sciences, Meerut.

[3]Dr. Deepti Saxena, Associate Professor, Saraswathi Institute of Medical Sciences, Hapur.

[4]Dr. Chirag Chadha, Associate Professor, Saraswathi Institute of Medical Sciences, Hapur.

[5]Dr. Rishabh Raj, Assistant Professor, Saraswathi Institute of Medical Sciences, Hapur.

Corresponding Author: Dr. Nupur Priya, Saraswathi Institute of Medical Sciences, Hapur.

How to citation this article: Dr. Nupur Priya, Dr. Sachin Agarwal, Dr. Deepti Saxena, Dr. Chirag Chadha, Dr. Rishabh Raj, "A Comparative Study of Efficacy and Safety of Intralesional Injections of Vitamin D3, MMR Vaccine and Acyclovir in Management of Cutaneous Warts", IJMACR- June - 2025, Volume – 8, Issue - 3, P. No. 92 – 102.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Cutaneous warts, caused by human papillomavirus, are common benign skin lesions with various treatment options, including immunotherapy, which has gained attention for its ability to stimulate cell-mediated immunity and promote wart clearance. This study compared the efficacy and safety of intralesional injections of Vitamin D3, MMR vaccine, and acyclovir in the management of verruca vulgaris. A total of 105 patients were divided into three groups, each receiving intralesional injections of one of the treatments at two-week intervals, with a maximum of three sessions. The results showed that while initial improvements after the first session were comparable across all groups, significant differences emerged after the final session. The MMR group demonstrated superior efficacy, with 57.14% of patients achieving excellent improvement, com- pared to 28.57% in the Vitamin D3 group and 42.85% in the acyclovir group (p=0.00105). Additionally, the MMR group had the lowest proportion of patients with no improvement (11.42%), compared to the Vitamin D3 group (20%) and the acyclovir group (57.1%) (p=0.0045). Safety profiles also favored the MMR vaccine, which showed fewer adverse effects compared to Vitamin D3 and acyclovir. The findings suggest that intralesional MMR is a more effective and safer treatment option for cutaneous warts than intralesional Vitamin D3 or acyclovir. This supports the growing evidence for immunotherapy as a promising approach in managing cutaneous warts.

Keywords: Cutaneous Warts, Intralesional Injections, Human Papillomavirus, MMR, Acyclovir, Vitamin D3

Introduction

Warts are verrucous, exophytic lesions caused by human papillomaviruses (HPVs) that infect basal keratinocytes through disrupted epithelial barriers. Various subtypes, such as common warts (verruca vulgaris), flat warts (verruca plana), filiform warts (verruca filiformis), and genital warts (condyloma acuminatum), arise from specific HPV types, including 1, 2, 4, 27, 57, and 63. Infected keratinocytes proliferate abnormally within the epidermis, forming thickened, warty papules, often on trauma-prone areas where epithelial barriers are more susceptible to viral entry. Affecting approximately 10% of the population, warts are a prevalent dermatological com- plaint, particularly in children and humid climates like India, where transmission is facilitated by moisture. Epidemiological studies highlight their significant presence in pediatric populations and the male predominance among affected individuals.

While largely benign, warts can cause discomfort, bleeding, and cosmetic concern, leading to frustration among patients. Their recurrence and resistance to treatment pose challenges for both pa- tients and healthcare providers. Current treatments range from destructive methods like cryotherapy and surgery to immunotherapy and antiviral applications. However, many traditional treatments are associated with tissue damage, higher recurrence rates, and inconvenience due to frequent medical visits. Home remedies, such as duct tape therapy, are also less effective.

Emerging therapies, particularly intralesional approaches, have shown promise in treating recalcitrant warts, especially in challenging regions like palmoplantar and periungual areas. Intralesional immunotherapies, such as bleomycin, PPD, and C. albicans antigen, enhance systemic immune responses, enabling the clearance of warts at both treated and distant sites. These methods have demonstrated shorter treatment durations, higher efficacy, and reduced side effects and recurrence rates compared to conventional therapies.

Recent interest has focused on intralesional injections of Vitamin D3, MMR vaccine, and acyclovir for wart management. The MMR vaccine, universally available and cost-effective, stimulates immune responses against HPV. Acyclovir, known for its efficacy against DNA viruses, is being explored for its potential in wart treatment. Vitamin D derivatives regulate epidermal cell proliferation and cytokine production, enhancing antimicrobial pep- tide expression. Despite their potential, no FDA- approved treatment or consensus exists regarding the most effective intralesional therapy. This study was designed to compare the efficacy and safety of intralesional injections of Vitamin D3, MMR vaccine, and acyclovir in the management of cutaneous warts, addressing the need for a reliable, effective, and patient-friendly treatment option.

Methodology

A prospective study was conducted between March 2022 and February 2025 to evaluate the efficacy and safety of intralesional Vitamin D3, acyclovir, and MMR vaccine in the treatment of cutaneous warts. A total of 105 patients diagnosed with cutaneous warts at the Dermatology Department of Saraswathi Institute of Medical Sciences and Hospital were included. Each treatment group comprised 35 patients: Group A received intralesional Vitamin D3, Group B received intralesional acyclovir, and Group C received intralesional MMR vaccine.

Patients were eligible if they had clinically diagnosed warts without prior treatment for at least six months, were aged between 14 and 55, and provided informed consent. Exclusion criteria included secondary infections, pregnancy or lactation, keloidal tendency, immunosuppression, hypersensitivity to intralesional injections, relevant medical conditions (e.g., meningitis, asthma, hypervitaminosis D), and anogenital warts. Diagnosis was based on clinical history and characteristics, with demographic and clinical data recorded using a structured questionnaire during the baseline visit.

Intralesional Vitamin D3 was administered as 0.2 ml of cholecalciferol (15 mg/ml) injected into the base of each wart after pre-administration of 0.2 ml lignocaine. Intralesional acyclovir was prepared by diluting a 250 mg vial with saline to achieve a 70 mg/ml solution, and 0.1 ml was injected into each wart. For MMR vaccine, 0.5 ml was injected into the largest wart. Treatments were repeated bi- weekly for up to three sessions, and patients were in- structed to avoid topical or oral therapies during the treatment period. Follow-up assessments were con- ducted every two weeks for the first two months and monthly thereafter, with evaluations for therapeutic response, recurrence, and adverse effects extending six months post-treatment.

Efficacy outcomes were categorized as excellent (>75% reduction in wart size and lesion count), moderate (50–74%), mild (25–49%), or no response (<25%). Data were analyzed using IBM-SPSS version 29.0. Quantitative variables were expressed as mean ± standard deviation, and qualitative variables as counts or percentages. Differences between groups were assessed using Chi-square and One-Way ANOVA tests, with Tukey's HSD post hoc test applied for pairwise comparisons. Statistical significance was set at $P < 0.05$. This study aimed to pro- vide a comparative evaluation of the three intralesional therapies, offering insights into optimal management strategies for cutaneous warts.

Results

The age distribution across the treatment groups revealed the following mean ages: 28.54 years for Group A (Vitamin D3), 32.26 years for Group B (Acyclovir), and 30.89 years for Group C (MMR Vaccine). The analysis of variance (ANOVA) showed no statistically significant difference in age between the groups, as indicated by the p-value of 0.1784 (Table 1).

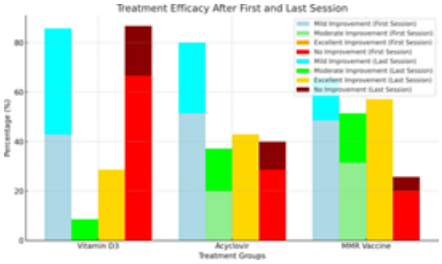

Fig. 1: The treatment efficacy after the first and last session

The gender distribution across the groups was also assessed. In Group A (Vitamin D3), 57.14% of the participants were male, and 42.86% were female. Group B (Acyclovir) had a slightly higher proportion of males (62.86%) compared to females (37.14%). Group C (MMR Vaccine) had a gender distribution of 60% male and 40% female. The Chi-square test revealed no significant difference in the gender distribution across the groups ($p = 0.821$) (Table 2).

Clinical characteristics of the warts, including the number and size of warts, were also compared. The median number of warts in Group A (Vitamin D3), Group B (Acyclovir), and Group C (MMR Vaccine) was 2, with interquartile ranges (IQR) of 1–3, 1–4, and 1–5, respectively. The median wart size was 4 mm in all groups, with IQRs ranging from 3 to 5 mm.

Statistical analysis showed no significant differences in the number (p = 0.2498) or size (p = 0.1794) of warts across the treatment groups (Table 3).

In terms of treatment efficacy, after the first session, the majority of participants in all groups re- ported no improvement. Group A (Vitamin D3) showed that 66.67% of participants experienced no improvement. A higher percentage of participants in Group B (Acyclovir) and Group C (MMR Vaccine) showed moderate improvement (20% and 31.42%, respectively). The Kruskal-Wallis test indicated no significant difference in treatment efficacy after the first session (p = 0.175) (Table 4).

However, after the final session, significant improvements were observed across the groups. In Group A (Vitamin D3), 42.85% of participants re- ported mild improvement, 8.57% reported moderate improvement, and 28.57% reported excellent improvement, with a statistically significant p-value of 0.00105. In Group B (Acyclovir), 42.85% of participants showed excellent improvement, while Group C (MMR Vaccine) had the highest proportion of participants showing excellent improvement (57.14%). These differences in treatment efficacy after the final session were statistically significant, with a p-value of 0.00105 (Table 4).

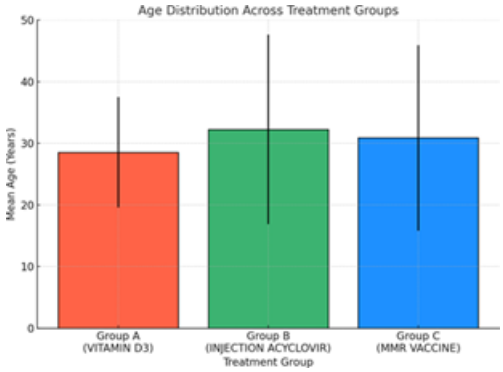

Figure 2: Age Distribution

Table 1: Age Distribution Across Treatment Groups

Treatment Group	Mean Age (Years)	Standard Deviation (Years)	P-value (ANOVA)
Group A: Vitamin D3	28.54	8.95	0.1784
Group B: Acyclovir	32.26	15.39	
Group C: MMR Vaccine	30.89	15.06	

Table 2: Gender Distribution Across Treatment Groups

Treatment Group	Male Count (%)	Female Count (%)	P-value (Chi-Square Test)
Group A: Vitamin D3	20 (57.14%)	15 (42.86%)	0.821
Group B: Acyclovir	22 (62.86%)	13 (37.14%)	
Group C: MMR Vaccine	21 (60.00%)	14 (40.00%)	

Table 3: Clinical Characteristics of Warts Across Groups

Clinical Parameter	Group A: Vitamin D3	Group B: Acyclovir	Group C: MMR Vaccine	P-value
Number of Warts (Median, IQR)	2 (1–3)	2 (1–4)	2 (1–5)	0.2498
Size of Warts (mm, Median, IQR)	4 (3–5)	4 (3–5)	4 (3–5)	0.1794

Table 4: Treatment Efficacy after First and Last Session

Treatment Group	Mild Improvement (%)	Moderate Improvement (%)	Excellent Improvement (%)	No Improvement (%)	P-value (Kruskal-Wallis Test)
After First Session					
Group A: Vitamin D3	42.85	0	0	66.67	0.175
Group B: Acyclovir	51.42	20.00	0	28.57	
Group C: MMR Vaccine	48.57	31.42	0	20.00	
After Last Session					
Group A: Vitamin D3	42.85	8.57	28.57	20.00	0.00105**
Group B: Acyclovir	28.57	17.14	42.85	11.42	
Group C: MMR Vaccine	17.14	20.00	57.14	5.71	

Discussion

In our study, 57.14% of patients in the MMR vaccine group showed a complete response, followed by 42.85% in the acyclovir group and 28.57% in the vitamin D group. These results are consistent with Alkady et al. (2023), who found MMR, vitamin D3, and bleomycin significantly more effective than a control group, although no significant differences were noted between these treatments. Joshi et al. (2023) compared MMR vaccine and vitamin D3 for treating multiple warts and found vitamin D3 more effective for filiform warts, while the efficacy for other wart types was similar. Both treatments were equally effective in clearing distant warts. Acyclovir, as documented in studies by Meghana Reddy (2023) and Elsayed et al. (2021), was highly effective in wart resolution, though side effects like pain and burning sensations were reported. These findings contrast with Alkady et al., whose study showed better therapeutic responses for MMR and vitamin D3 compared to acyclovir.

In studies by Nofal et al. (2015) and Naseem (2013), MMR vaccination demonstrated high rates of complete clearance, especially for distant warts. This corresponds with our finding that MMR was more effective for treating the target wart but similarly effective in clearing distant warts. Agrawal et al. (2025) also reported positive outcomes with acyclovir, particularly for palmoplantar warts. Notably, intralesional MMR and vitamin D3 therapies generally exhibited good safety profiles, with mild, transient side effects, which aligns with our observations.

The mechanisms underlying the effectiveness of these treatments are varied. MMR may stimulate a systemic immune response, while vitamin D3 appears to modulate cytokine production, enhancing the immune function in the skin. Acyclovir, conversely, acts by targeting viral replication via its interaction with herpesvirus DNA. Vitamin D3's role in immune modulation is particularly interesting, as it can enhance T-cell responses, possibly aiding in the clearance of warts by boosting local immunity.

Regarding safety, MMR exhibited a higher safety profile than both acyclovir and vitamin D3, with fewer side effects overall. However, pain and blister- ing were common side effects across all treatments. These adverse effects were mild and transient, and no serious long-term

complications were reported, reinforcing the safety of these therapies in managing warts.

Despite these promising findings, the study does have several limitations. The relatively small sample size and short follow-up period prevent the drawing of definitive conclusions regarding the long-term efficacy and recurrence of warts. A larger sample size and extended follow-up would provide more robust data on the sustained effects of these treatments. Additionally, the absence of a placebo group limits our ability to fully isolate the therapeutic effects of the intralesional treatments from potential placebo effects, suggesting that future studies could benefit from a more rigorously controlled design.

Conclusion

Intralesional MMR vaccine injections demon- strated superior efficacy in the treatment of cutaneous warts compared to acyclovir and Vitamin D3, achieving the highest rates of complete clearance and minimal recurrence. The favorable safety pro- file and minimal side effects of the MMR vaccine highlight its potential as a promising therapeutic option. While acyclovir and Vitamin D3 also showed effectiveness, particularly in certain patient sub- groups, their response rates were lower. Given the psychological and social impact of warts, the selection of treatment should carefully consider both efficacy and the side effect profile. Further studies with larger sample sizes and extended follow-up periods are recommended to confirm these findings and assess long-term outcomes.

References

1. James WD, Elston D, Berger T. Andrew's diseases of the skin E-book: clinical dermatology. Elsevier Health Sciences; 2011 Mar 21.
2. Al Aboud AM, Nigam PK. Wart. Treasure Island (FL): StatPearls Publishing; 2023.
3. Hay RJ, Johns NE, Williams HC, Bolliger IW, Dellavalle RP, Margolis DJ, et al. The global burden of skin disease in 2010: an analysis of the prevalence and impact of skin conditions. J In- vest Dermatol 2014;134:1527-34.
4. Laxmisha C, Thappa DM, Jaisankar TJ. Viral warts-A clinico-epidemiological study. Indian J Dermatol 2003 Jul 1;48(3):142-5.
5. Sharma RC, Mendiratta V. Clinical profile of cutaneous infections and infestations in the paediatric age group. Indian J Dermatol 1999 Oct 1;44(4):174-8.
6. Mursic I, Vcev A, Kotrulja L, Kuric I, Milavic T, Sustic N, et al. Treatment of verruca vul- garis in traditional medicine. Acta Clin Croat 2020;59:745-50.
7. Mattoo A, Bhatia M. Verruca vulgaris of the buccal mucosa: a case report. J Cancer Res Ther 2018;14:454-6.
8. Loo SK-F, Tang WY. Warts (non-genital). BMJ Clin Evid 2014;2014:1710.
9. Martin A, Thatiparthi A, Nourmohammadi N, Nguyen C, Sung C, Mesinkovska NA. Emerg- ing intralesional treatments for plantar warts: a systematic review. J Drugs Dermatol 2022 Dec 1;21(12):1322-9.
10. Aldahan AS, Mlacker S, Shah VV, Kamath P, Alsaidan M, Samarkandy S, et al. Efficacy of intralesional immunotherapy for the treatment of warts: a review of the literature. Dermatol Ther 2016;29:197-207.
11. Ju HJ, Park HR, Kim JY, Kim GM, Bae JM,Lee JH. Intralesional immunotherapy for non- genital warts: a systematic review and meta- analysis.

Indian J Dermatol Venereol Leprol 2022;88:724-37.

12. Fields JR, Saikaly SK, Schoch JJ. Intralesional immunotherapy for pediatric warts: a review. Pediatr Dermatol 2020;37:265-71.
13. Chauhan PS, Mahajan VK, Mehta KS, Rawat R, Sharma V. The efficacy and safety of intralesional immunotherapy with measles, mumps, rubella virus vaccine for the treatment of common warts in adults. Indian Dermatol Online J 2019 Jan-Feb;10(1):19-26.
14. Elsayed A, Nassar A, Marei A, Hoseiny HAM, Alakad R. Intralesional Acyclovir: A potential therapeutic option for cutaneous warts. J Cutan Med Surg 2022 Jan-Feb;26(1):25-30.
15. Latif I, Sultan J, Aslam A, Hassan I, Devi R. Role of intralesional Vitamin D3 in the treatment of cutaneous warts. J Cutan Aesthet Surg 2021 Oct-Dec;14(4):404-8.
16. Mullen SA, Myers EL, Brenner RL, Nguyen KT, Harper TA, Welsh D, Keffer S, Mueller J, Whitley MJ. Systematic review of intralesional therapies for cutaneous warts. JID Innovations 2024 May 1;4(3):100264.
17. Lipke MM. An armamentarium of wart treatments. Clin Med Res 2006;4(4):273-93.
18. Nischal KC, Sowmya CS, Swaroop MR, Agrawal DP, Basavaraj HB, Sathyanarayana BD, et al. A novel modification of the autoimplantation therapy for the treatment of multiple, recurrent and palmoplantar warts. J Cutan Aesthet Surg 2012;5(1):26-9.
19. Bilgic A, Akman-Karakas A. Bleomycin ther- apy using multipuncture technique for resistant warts. Turk J Dermatol 2019;13:91-3.
20. Nimbalkar A, Pande S, Sharma R, BorkarM. Tuberculin purified protein derivative immunotherapy in the treatment of viral warts. Indian J Drugs Dermatol 2016;2(1):19.
21. Van Gasse TT, Miller. Incidence of verruca plantaris in a school population. Arch Paediatr 1958;75:279-84.
22. Khopkar US, Rajagopalan M, Chauhan AR, Kothari-Talwar S, Singhal PK, Yee K, et al. Prevalence and burden related to genital warts in In- dia. Viral Immunol 2018;31(5):346-51.
23. Chandrashekar L, Thappa DM, Jaisankar TJ. Viral warts—a clinico-epidemiological study. Indian J Dermatol 2003;48:142-5.
24. Goldschmidt H, Kligman AM. Experimental inoculation of human with ectodermotropic virus. J Invest Dermatol 1958;31:175-8.
25. Oriel JD. Natural history of genital warts. Br J Vener Dis 1971;1:47.
26. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Human papillomaviruses. Lyon (FR): International Agency for Research on Cancer; 2007. (IARC Monographs on the Evaluation of Carcinogenic Risks to Hu- mans, No. 90.) 1, Human Papillomavirus (HPV) Infection. Available from: https://www.ncbi. nlm. nih.gov/books/NBK321770/
27. Morshed K, Polz-Gruszka D, Szymański M, Polz-Dacewicz M. Human papillomavirus (HPV)– structure, epidemiology and pathogen- esis. Otolaryngol Pol 2014;68(5):213-9.
28. Harden ME, Munger K. Human papillomavirus molecular biology. Mutat Res Rev Mutat Res 2017;772:3-12.
29. Gentles JC, Evans EGV. Foot infections in swim-

ming baths. Br Med J 1973;3:260.

30. Vorsters A, Van Damme P, Bosch FX. HPV vaccination: Are we overlooking additional opportunities to control HPV infection and transmission? Int J Infect Dis 2019;88:110-2.
31. Liu Z, Rashid T, Nyitray AG. Penises not required: a systematic review of the potential for human papillomavirus horizontal transmission that is non-sexual or does not include penile penetration. Sexual Health 2015;13(1):10-21.
32. Rock B, Naghashfar Z, Barnett N. Genital tract papillomavirus infection in children. Arch Dermatol 1986;122:1129-32.
33. Rathi S, Hajare SA, Jaiswal S, Agrawal S, Kherde A, Mishra D, et al. Pattern of sexually transmit- ted infections: A retrospective study from a ter- tiary care hospital in Central India. J Clin Diagn Res 2021;15(1).
34. Brentyans MH, Yung-Yue KA, Lee PC, Tyring SK. Human papillomavirus: a review. Dermatol Clin 2002;20:315-19.
35. Hammer A, Rositch A, Qeadan F, Gravitt PE, Blaakaer J. Age-specific prevalence of HPV 16/18 genotypes in cervical cancer: a system- atic review and meta-analysis. Int J Cancer 2016; 138 (12):2795-803.
36. Bacaj P, Burch D. Human papillomavirus infection of the skin. Arch Pathol Lab Med 2018 Jun;142(6):700-5.
37. Stanley MA, Sterling JC. Host responses to infection with human papillomavirus. Curr Probl Dermatol 2014;45:58-74.
38. Jablonska S, Orth G, Obalek S, Croissant O. Cutaneous warts: Clinical, histologic, and virologic correlations. Clin Dermatol 1985;3(4):71-82.
39. Rübben A, Kalka K, Spelten B, Großendorf-Conen EI. Clinical features and age distribution of patients with HPV 2/27/57-induced common warts. Arch Dermatol Res 1997;289(6):337-40.
40. Abeck D, Tetsch L, Lüftl M, Biedermann T. Extragenital cutaneous warts–clinical presentation, diagnosis and treatment. JDDG: J der Deutschen Dermatol Gesellschaft 2019;17(6):613-34.
41. Thomas KK, Hughes JP, Kuypers JM. Concurrent and sequential acquisition of different gen- ital human papillomavirus types. J Infect Dis 2000; 182:1097-102.
42. Goldstein BG, Goldstein AO, Morris-Jones R, Dellavalle RP, Levy ML, Rosen T, Ofori AO. Cuta- neous warts (common, plantar, and flat warts). UpToDate. Updated 7 Mar 2018; cited 29 Jan2019.
43. Asghar N, Asghar M, Rehman N, Afridi IU, Khalid S. Epidemiological and clinical pat- terns of viral warts presenting to dermatology OPD of Hayatabad Medical Complex, Peshawar: Epidemiological and clinical patterns of viral warts. J Pak Ass Dermatol 2022;32(1):78-84.
44. Albuquerque A, Medeiros R. New insights into the role of human papillomavirus in anal can- cer and anal wart development. Acta Cytologica 2019; 63 (2):118-23.
45. Lacarrubba F, Verzì AE, Quattrocchi E, Micali G. Cutaneous and anogenital warts. In: Atlas of Pediatric Dermatoscopy 2018. Springer, Cham. p. 35-44.
46. Kilic A, Ulku ME. Anogenital warts: an up- date on human papillomavirus, clinical man- ifestations, and treatment strategies. Mucosa 2019;2(2):30-40.

47. Myers DJ, Kwan E, Fillman EP. Epidermodysplasia verruciformis.
48. Moore S, Rady P, Tyring S. Acquired epidermodysplasia verruciformis: clinical presenta- tion and treatment update. Int J Dermatol 2021 Aug 17.
49. Al Rudaisat M, Cheng H. Dermoscopy features of cutaneous warts. Int J Gen Med 2021;14:9903- 12.
50. Aldana-Caballero A, Marcos-Tejedor F, Mayordomo R. Diagnostic techniques in HPV infec- tions and the need to implement them in plan- tar lesions: A systematic review. Expert Rev Mol Diagn 2021;21(12):1341-8.
51. O'Mahony C, Gomberg M, Skerlev M, Alraddadi A, de las Heras-Alonso ME, Majewski S, et al. Position statement for the diagnosis and management of anogenital warts. J Eur Acad Dermatol Venereol 2019;33(6):1006-19.
52. Moscicki AB. Impact of HPV infection in adolescent populations. J Adolesc Health 2005; 37(6):S3-9.
53. Jablonska S, Orth G, Obalek S, Croissant O. Cutaneous warts: Clinical, histologic, and virologic correlations. Clin Dermatol 1985;3(4):71-82.
54. Gross G, Pfister H, Hagedorn M, GissmannL. Correlation between human papillomavirus (HPV) type and histology of warts. J Invest Der- matol 1982;78(2):160-4.
55. Wang Y, Chen M, Zhang L, Ding Y, Luo Y, Xu Q, et al. Rapid detection of human papillomavirus using a novel leaky surface acoustic wave pep- tide nucleic acid biosensor. Biosens Bioelectron 2009; 24(12):3455-60.
56. Joh J, Jenson AB, Proctor M, Ingle A, Silva KA, Potter CS, et al. Molecular diagnosis of a laboratory mouse papillomavirus (MusPV). Exp Mol Pathol 2012;93(3):416-21.
57. Abreu AL, Souza RP, Gimenes F, Consolaro ME. A review of methods for detecting human papillomavirus infection. Virol J 2012;9:262.
58. Das S. Human papillomavirus infection: Management and treatment. In: Human Papillomavirus 2020 Aug 7. Intech Open.
59. Messing AM, Epstein WL. Natural history of warts - A two-year study. Arch Dermatol 1963;87:306.
60. Sterling JC. Virus infections. In: Burns T, Breathnach S, Cox N, Griffith C, editors. Rook's Textbook of Dermatology. 7th ed. Oxford: Blackwell Publishing; 2004. p. 25.1-25.83.
61. Von Krogh G. Condylomata acuminata - an updated review. Semin Dermatol 1983;2:109-29.
62. Beutner KR, von Krogh G. Current status of podophyllotoxin for the treatment of genital warts. Semin Dermatol 1990;9:148-51.
63. Chamberlain MJ, Reynolds AL, Yeoman WB. Toxic effect of podophyllum application in pregnancy. Br Med J 1972;3:391-2.
64. Slater GE, Rumack BH, Peterson RG. Podophyllin poisoning - Systemic toxicity following cutaneous application. Obstet Gy- necol 1978;52:94-6.
65. Leslie KO, Shitamoto B. The bone marrow in systemic podophyllin toxicity. Am J Clin Pathol 1982;77:478-80.
66. Epstein WL, Kligman AM. Treatment of warts with cantharidin. AMA Arch Dermatol 1958; 77(5):508-11.
67. Kartal Durmazlar SP, Atacan D, Eskioglu F. Cantharidin treatment for recalcitrant facial flat warts: a preliminary study. J Dermatol Treat 2009; 20(2):114-9.
68. Miller DM, Brudell RT. Human papilloma in-

fection: Treatment options for warts. Am Fam Physician 1996;53:135-43.

69. Al-Hamdi KI, Al-Rahmani MA. Evaluation of topical potassium hydroxide solution for treatment of plane warts. Indian J Dermatol 2012;57(1):38-41.
70. Leman JA, Bentox C. Verrucas. Guidelines for management. Am J Clin Dermatol 2000;1:143-9.
71. Thappa DM, Chiramel MJ. Evolving role of immunotherapy in the treatment of refractory warts. Indian Dermatol Online J 2016;7(5):364- 70.
72. Mulhem E, Pinelis S. Treatment of nongen- ital cutaneous warts. Am Fam Physician 2011; 84 (3):288-93.
73. Al-Guarairi FT, Al-Waiz M, Sharquie KE. Oral zinc sulphate in the treatment of recalcitrant vi- ral warts: randomized placebo-controlled clin- ical trial. Br J Dermatol 2002;146:423-31.
74. Dall'oglio F, D'Amico V, Nasca MR, Micali G. Treatment of cutaneous warts: an evidence- based review. Am J Clin Dermatol 2012;13(2):73- 96.
75. Gharib K, Taha A, Elradi M. Intralesional acyclovir versus intralesional Hepatitis-B vaccine in treatment of resistant plantar warts: a ran- domized controlled trial. Arch Dermatol Res 2024; 316 (6):325.
76. Alkady OH, Khalil KT, Ibrahim SE, Farag RT, Rezk SM. Intralesional injection of mumps, measles, and rubella vaccine, bleomycin, and vitamin D3 in warts treatment. Menoufia Med J 2023;36(3):3.
77. Joshi VD, Pradhan SN, Belgaumkar VA. Evaluation of efficacy and safety of intralesional vitamin D3 in comparison with intralesional measles, mumps and rubella (MMR) vaccine in the treatment of multiple cutaneous warts. Der- matol Rev 2024;110(6):675-81.
78. Reddy EM, Rajashekar TS, Kumar KS, Reddy ME, Rajashekar TS. A comparative study of intralesional acyclovir vs immunotherapy for treatment of viral warts. Cureus 2023 May 9;15(5).
79. Nofal A, Nofal E, Yosef A, Nofal H. Treatment of recalcitrant warts with intralesional measles, mumps, and rubella vaccine: A promising approach. Int J Dermatol 2015;54(6):667-71.
80. Naseem R, Aamir S. The efficacy of intrale- sional measles, mumps, rubella (MMR) anti- gen in treatment of common warts. Pak J Med Health Sci 2013;7(4):1130-3.
81. Sobhy Mohamad N, Badran F, Yakout E. Evaluation of the efficacy of a combination – measles, mumps and rubella vaccine in the treatment of plantar warts. Our Dermatol On- line 2013; 4(4):463-7.
82. Shah A, Patel D, Ravishankar V. Measles, mumps and rubella vaccine as an intralesional immunotherapy in treatment of warts. Int J Res Med Sci 2016;4(2):472-6.
83. Raju J, Swamy AV, Nanjunda Swamy BL, Raghavendra KR. Intralesional measles,mumps and rubella (MMR) vaccine-An effec- tive therapeutic tool in the treatment of wart. J Evid Based Med Healthc 2015 Nov 23;2:8548-51.
84. Rohit V, Gajula N. Role of intralesional measles mumps rubella vaccine in cutaneous warts: A case control study. 2017 Dec;57-60.
85. Chauhan PS, Mahajan VK, Mehta KS, Rawat R, Sharma V. The efficacy and safety of intralesional immunotherapy with measles, mumps, rubella virus vaccine for the treatment of com-

mon warts in adults. Indian Dermatol Online J 2019 Jan-Feb;10(1):19-26.

86. Aktaş H, Ergin C, Demir B, Ekiz Ö. Intrale- sional vitamin D injection may be an effective treatment option for warts. J Cutan Med Surg 2016; 20 (2):118-22.
87. Jakhar D, Kaur I, Misri R. Intralesional vita- min D3 in periungual warts. J Am Dermatol 2018; 80 (5):e111-e112.
88. Raghukumar S, Ravikumar BC, Vinay KN, Suresh MR, Aggarwal A, Yashovardhana DP. In- tralesional Vitamin D3 injection in the treat- ment of recalcitrant warts: A novel proposition. J Cutan Med Surg 2017;21(4):320-4.
89. Kareem IMA, Ibrahim IM, Mohammed SFF, Ahmed AA. Effectiveness of intralesional vita- min D3 injection in the treatment of common warts: Single blinded placebo controlled study. Dermatol Ther 2019;32(2):e12882.
90. El-Taweel AEA, Salem RM, Allam AH. Cigarette smoking reduces the efficacy of intralesional vi- tamin D in the treatment of warts. Dermatol Ther 2019;32(2):122.
91. Nofal A, Nofal E. Intralesional immunother- apy of common warts: Successful treatment with mumps, measles and rubella vaccine. J Eur Acad Dermatol Venereol 2010;24(10):1166-70.