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Do Painted Nails Increase Bacterial Transmission in Healthcare Environments? A Literature Review

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ABSTRACT

Introduction: Healthcare-associated infections (HAIs) continue to be a significant global concern, leading to increased patient morbidity, prolonged hospitalizations, and elevated healthcare costs. Hand hygiene remains the most critical part of infection prevention, however the use of nail polish and artificial nails has raised questions regarding their possible contribution to bacterial transmission.

Aim of study: The aim of this study is to collect and examine whether painted nails significantly influence bacterial spread in healthcare settings, focusing on nail surface properties, hand hygiene practices and existing guidelines.

Materials and Methods: A literature review was conducted with PubMed and other medical databases using appropriate keywords. Data from clinical trials and reviews were analyzed.

Conclusions: Intact nail polish does not pose a significant risk for bacterial transmission in healthcare environments when proper hand hygiene protocols are followed. Emphasis should remain on keeping short, clean nails and adhering to strict hand hygiene practices to reduce healthcare-associated infections (HAIs).

Keywords: nail polish, hand hygiene, healthcare-associated infections, articial fingernails in a hospital environment

Introduction

Healthcare-associated infections (HAIs) remain a significant concern in hospital environments, often leading to prolonged hospital stays, increased healthcare costs, and higher patient morbidity and mortality. Proper hand hygiene has been documented to be one of the most effective strategies in preventing the transmission of pathogens in the healthcare setting [1]. However, the use of personal accessories, such as nail polish and artificial nails, has raised concerns regarding their potential to compromise the effectiveness of hand hygiene practices [2]. This review aims to examine the existing literature comparing the bacterial burden on natural nail plates versus polished nails in healthcare workers, exploring their contributions to the spread of nosocomial pathogens.

The Role of Nail Surface Characteristics

The human nail represents a complex anatomical structure, originating in the nail matrix, which is responsible for the continuous growth of the nail plate throughout life [3]. The nail plate is embedded within the lateral and proximal nail folds and is protected proximally by the cuticle, a keratinized skin structure. Composed of keratinized epithelial cells, the nail plate typically features a smooth dorsal surface, though longitudinal ridges may be present and vary in prominence. Changes in the nail plate are commonly associated with dermatological or systemic diseases [4]. Both the nail plate and the periungual area provide an environment for bacterial colonization, while the hyponychium, a region beneath the nail's free edge, is particularly challenging to clean mechanically during hand hygiene practices [2, 5, 6]. The condition of the nail plate is a significant factor related to bacterial adhesion, colonization, and hand hygiene efficacy. Topography of the nail surface, which includes its roughness or smoothness, might influence the extent of adhesion of bacteria to it. Irregularities on the surface of the nail, such as longitudinal ridges and micro-damages, may act as a protective niche for microorganisms. Such imperfections could prevent the mechanical removal of bacteria during handwashing and, thus, increase the chance of bacterial colonization. The surface of polished nails might be smoother, potentially reducing bacterial adhesion; on the other hand, polishing might also make the surface more difficult to clean thoroughly. Nevertheless, well-maintained painted nails do not show significantly higher bacterial loads compared to natural nails, as long as proper length and hand hygiene are practiced [2, 7].

Natural bacterial flora on the nail plate

Research by Kulkarni et al. in “Microbial counts in hands with and without nail varnish after surgical skin preparation: a randomized control trial” demonstrated that 15% of participants had bacterial presence on their natural nail plates even after cleansing with 10% povidone-iodine. The identified bacteria included Staphylococcus spp. (e.g., coagulase-negative staphylococci), Bacillus spp., and Paenibacillus spp. Additionally, 57.5% of participants had bacterial presence in the hyponychium area, including organisms such as Acinetobacter spp., Streptococcus spp., and Corynebacterium spp [6]. Rayan and Flournoy’s study on the microbiological flora of human fingernails revealed that both resident and transient bacteria colonize the nail plate.

The most frequently isolated bacterium was Staphylococcus epidermidis, found in 95% of participants, alongside other bacteria such as Bacillus sp., Klebsiella oxytoca, and Enterobacter agglomerans, as well as fungi including Candida albicans, C. glabrata, and molds like Aspergillus sp. and Penicillium sp.. In a study among nurses, "Effectiveness of hand disinfection depending on the type of nail plate coating," researchers found that natural nails still harbored bacteria after hand disinfection. Cultures from nail plates identified coagulase-negative staphylococci, such as Staphylococcus epidermidis, and Bacillus spp. These findings highlight the persistence of bacterial flora, including coagulase-negative staphylococci, Streptococcus spp., Enterococcus faecium, and Micrococcus spp. While Staphylococcus epidermidis is a common commensal organism, it can become pathogenic under specific conditions, such as skin damage or genetic mutations, underscoring its relevance in clinical settings [3, 4, 8].

WHO Guidelines on Nail Hygiene

The World Health Organization (WHO) emphasizes the critical role of nail hygiene in the prevention of infections among health professionals. WHO recommendations stipulate that health personnel should have short, clean, and unpainted nails. It strongly discourages the use of artificial nails or extensions because it has been associated with higher bacterial counts and increased risk of spreading healthcare-associated infections [9]. The proposed guidelines are intended to reduce the risk of pathogen accumulation and ensure the highest level of patient safety within healthcare settings [1].

Hand Hygiene

Proper hand hygiene is a fundamental aspect of preventing healthcare-associated infections (HAIs) in medical settings [11-13]. According to the World Health Organization (WHO) and studies conducted in Europe, the prevalence of HAIs ranges from 4.6% to 9.3% in hospitals, with rates as high as 31.8% in intensive care units (ICUs) [1]. Healthcare workers (HCWs) involved in direct patient care should strictly adhere to hand hygiene protocols, ensuring thorough cleaning of the hands and nails. It is essential to cover the entire surface of the hands with the recommended amount of cleansing or disinfecting agent for the specified duration [1,10]. Special attention should be given to the subungual (under-nail) area, which requires scrubbing with soap or an alcohol-based disinfectant for at least 20 seconds, potentially using a disposable brush to achieve adequate cleaning. Furthermore, compliance with the six-step handwashing technique outlined by the European Committee for Standardization in 1997 is advised [1, 14].

The use of hand jewelry, such as rings, by HCWs has been shown to impede proper hand hygiene and increase the risk of pathogen transmission [12]. Rings can trap moisture and create a favorable environment for microbial growth, significantly increasing the prevalence of Gram-negative bacilli and *Staphylococcus aureus*. [1, 11]. Additionally, glove powder accumulating beneath rings in a moist environment may irritate the skin, leading to barrier compromise and facilitating microbial colonization [11]. Irritations, loss of epidermis, or nail plate pathologies such as hyperkeratosis or nail splitting can weaken the natural protective barrier of the skin, promoting the accumulation of pathogens [10, 11].

Regular application of moisturizers, preferably those containing humectants, is recommended at least twice daily to counteract the drying effects of frequent handwashing and the use of alcohol-based disinfectants, which can weaken the skin's natural barrier and damage the nails. Tools used for nail care should either be disposable or sterilized using 60–90% isopropyl alcohol or an autoclave to ensure proper decontamination [10].

Divergent findings in the literature on the association between healthcare-associated infections (HAIs), patient-associated infections and nail polish or artificial nails.

The current scientific literature presents conflicting results regarding the impact of nail polish on healthcare-associated infections, with the influence remaining poorly defined [2, 22]. The colonization and growth of bacteria on the nail plate are influenced by a variety of factors, including hand hygiene practices in both workplace and home settings, the nature of the work performed, and nail length. Research clearly indicates that proper hand hygiene significantly reduces bacterial growth on the nail plate, both for natural nails and nails coated with polish [14, 15]. However, some studies also suggest that there is no statistically significant difference in bacterial colonization and growth between natural nails and those with nail polish [2]. Moreover, no significant differences in mean colony forming units (CFUs) counts were observed across various nail products following hand hygiene practices, both in the case of hand disinfection with povidone-iodine solution and with alcohol-based hand rub [16, 17]. Studies also do not provide evidence that gel nail polish is associated with increased bacterial colonization of nails, however, gel nail polish may be linked to more challenging disinfection of nails with alcohol-based solutions [18]. Nevertheless, the results of a 2024 study comparing unpolished nails, nails polished with standard nail polish, and nails painted with gel polish indicate that both initially and after disinfection with an alcohol-based solution, gel polish was associated with a lower bacterial growth rate compared to standard polish [19]. A randomized controlled trial conducted in 2022 with 885 non-emergent cases also demonstrated no association between healthcare workers and patients wearing fingernail polish and an increase in surgical site infections during cesarean deliveries [20]. Summing up, a numerous number of studies have demonstrated a statistically significant lack of effect of nail polish on bacterial counts among healthcare workers and patients, suggesting that nail varnish is not associated with an increased risk of HAIs or surgical site infections.

Conclusions

In conclusion, the available data submit that certain types of nail polish, particularly well-applied hybrid polish, do not interfere with the effectiveness of routine hand hygiene or surgical scrub. Risk of bacterial transmission associated with natural versus painted nail plates is not significantly different when proper hand hygiene and nail length maintenance are observed. The condition of the nail plate, including surface irregularities, can impact bacterial adherence. The current studies do not demonstrate a significant risk associated with the use of nail polish in terms of bacterial transmission; there is, however, a lack of modern research investigating the impact of today's nail polishes and disinfectants. Further research is needed to fully assess their impact on bacterial flora as well as the efficacy of hand hygiene practices.

In healthcare environments where hygiene is very important, both appropriate hand hygiene and nail care play a critical role in the prevention of bacterial transmission. Continued emphasis on hand hygiene education and adherence to WHO guidelines will be essential in minimizing infection risks.

Author's contribution

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