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Reuse of Implant Healing Abutments: A Narrative Review

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ABSTRACT

Healing abutments support peri-implant soft tissue healing and protect implants during osseointegration. Despite being marketed as single-use, reuse is widespread, raising concerns about sterilisation, microbial safety, and long-term outcomes. This review of 20 studies (2020–2025) shows that while abutments aid healing, sterilisation often fails to eliminate biofilm or residues. Reuse causes surface changes that promote bacterial adhesion and reduce cell viability. However, clinical evidence has not confirmed links to implant failure or peri-implantitis. Emerging solutions, such as antimicrobial coatings and drug-releasing systems, appear promising but require further validation.

Introduction

Implants are an essential component of modern dentistry, providing predictable and long-term solutions for tooth replacement and functional rehabilitation. Implant healing abutments are temporary components that support the maturation of peri-implant soft tissues at the same time protecting the underlying implant during the critical phase of osseointegration. Although they are typically supplied as single-use devices, their reuse in daily clinical practice is not uncommon. This behaviour is predominantly motivated by economic considerations, including the relatively high cost of these components, alongside the perception that following short-term intraoral use they often appear macroscopically intact and therefore suitable for further application. While the reuse of healing abutments may seem insignificant, it raises several concerns that warrant closer examination. One of the most critical issues is infection control and the risk of cross-contamination, particularly when implant placement is combined with bone augmentation procedures. Studies have shown that bacterial biofilms can persist even after standard sterilisation protocols, raising legitimate concerns about microbial safety and questioning the adequacy of existing decontamination methods for components that come into direct contact with the implant surface. Additionally, repeated sterilisation may alter the surface characteristics of the abutment, leading to discolouration, abrasion, and microstructural changes that could compromise cellular attachment, soft tissue integration, and long-term clinical outcomes. This review aims to summarise and critically assess the current literature on the reuse of implant healing abutments. By examining microbiological, material, and clinical aspects of this practice, the review seeks to clarify the risks involved and provide clinicians with a comprehensive and evidence-based perspective on the outcomes for patient safety and implant longevity.

Results.

HEALING ABUTMENTS' IMPACT ON TISSUE HEALING.

In addition to their fundamental mechanical function of protecting the implant fixture, healing abutments (HA) significantly influence the biological process of peri-implant soft tissue maturation and contour formation. In 2024, Narvekar et al. conducted a survey-based study and highlighted that HAs are in prolonged contact with peri-implant tissues, helping to establish a stable implant–abutment interface[1]. The surface properties of HAs also have a direct impact on soft tissue integration. In 2023, a randomised clinical trial by Italian practitioners demonstrated that argon plasma pre-treatment of HAs significantly reduced plaque accumulation and bleeding on probing, while promoting a healthier microbial environment. This suggests that even minor surface modifications can lead to clinically meaningful improvements in tissue response[2]. Soft tissue outcomes are also influenced by the morphology of the HA. In a controlled trial, conducted in 2024 in Thailand, it was found that customised HAs fabricated from PEEK preserved peri-implant buccal soft tissue volume and papilla height better than prefabricated titanium counterparts. Patients receiving customised HAs also reported lower pain scores and exhibited improved pink aesthetic scores at six months. These findings reinforce that HAs are not passive devices but rather critical determinants of both functional and aesthetic soft tissue healing[3].

STERILISATION EFFICACY AND MICROBIAL RISKS OF REUSED HEALING ABUTMENTS

The microbiological safety of reusing healing abutments (HAs) remains a controversial subject, as growing evidence indicates that conventional sterilisation methods may not fully eliminate microbial contaminants or restore the biological integrity of reused components. Although sterilisation protocols such as ultrasonic cleaning, enzymatic detergents, and autoclaving are routinely used in clinical practice, multiple studies have demonstrated that residual organic debris and bacterial biofilms can persist on reused HAs, posing a potential risk of cross-contamination between patients. In 2022, a cross-sectional survey was conducted in Brazil. It was found that nearly all implantologists reuse HAs, mostly using enzymatic cleaning followed by autoclaving. However, the authors highlighted that there is limited evidence supporting the complete effectiveness of these protocols in removing all organic residues[4]. This concern was confirmed by an *in vitro* investigation conducted by Italian practitioners in 2024, who found that although standard sterilisation successfully eliminated viable pathogens, residual surface proteins remained on

reused HAs, raising concerns about their long-term biocompatibility[5]. Similar conclusions were drawn in a systematic review conducted in Malaysia in 2022. It concluded that single-method decontamination techniques are often inadequate, recommending combined chemical and electrochemical approaches alongside autoclaving as more effective strategies for reducing residual contamination while minimising surface changes[6]. The clinical consequences of incomplete sterilisation have also been explored. In 2020, a laboratory study examined 185 titanium HAs that had undergone standard cleaning, disinfection, and autoclaving by Portuguese practitioners. Nearly 30% of the samples still had detectable biofilm, including pathogens such as *Aggregatibacter actinomycetemcomitans, Prevotella intermedia, and Enterococcus faecalis*. These findings highlight the resistance of biofilms and the difficulty of completely decontaminating reused HAs, even with high-temperature sterilisation[7]. In addition, clinical data published by Shelke et al. in 2024 showed that over 90% of questioned implantologists reuse HAs, often multiple times, and that repeated sterilisation can cause progressive surface roughness and porosity. These microtopographical changes create niches for bacterial adhesion and biofilm regrowth at the HA–implant interface, increasing the risk of peri-implant inflammation[8]. In line with this, in the same year, Naghsh et al. demonstrated that while adjunctive techniques such as sodium hypochlorite immersion and air polishing were more effective than autoclaving alone, none of the tested decontamination methods completely removed microbial residues[9].

SURFACE CHANGES IN HEALING ABUTMENTS AFTER STERILISATION

After multiple sterilisation or reuse cycles the physical and chemical integrity of HAs can be damaged. Early laboratory investigations have shown that even after a single implantation and sterilisation, titanium HAs exhibit surface discolouration, abrasions, and corrosion that cannot be restored to their original state, with reused components showing greater vulnerability to microbial colonisation and electrochemical degradation compared to unused controls[10]. Additional findings demonstrated that repetitive implantation and autoclaving cycles reduce host cell viability and enhance bacterial adhesion, indicating that surface roughness and oxide layer disruption adversely affect the tissue response to HAs[11]. In 2025, Lee et al. demonstrated that reused HAs display marked surface roughness, protein contamination, and the development of microgaps at the implant–abutment interface, which allowed bacterial leakage. However, these defects could be partially reduced by applying higher tightening torques during clinical use. This in vitro analysis further revealed that reused HAs, even when carefully sterilised, consistently revealed significantly larger microgaps and higher rates of bacterial leakage than unused controls. The study measured an average microgap of 43 µm in reused HAs compared with none in new components. This difference directly correlated with microbial infiltration. The authors also found that more than two tightening and loosening cycles significantly worsened bacterial leakage, and that leakage increased proportionally with time of incubation. Increasing the tightening torque to 15 Ncm eliminated the microgap entirely and significantly reduced bacterial leakage, highlighting torque control as a decisive clinical factor[12]. In addition to these clinical studies, controlled experimental research has also highlighted sterilisation-induced changes. A 2024 study from Saudi Arabia reported that repeated moist-heat sterilisation cycles significantly increased marginal gaps and surface roughness in titanium implant–abutment systems, although the degree of deterioration varied between different manufacturers[13].

CLINICAL COMPLICATIONS AND RISKS ASSOCIATED WITH HEALING ABUTMENTS REUSE

Although the reuse of HAs raises concerns about infection and peri-implant complications, current evidence suggests that clinical risks remain unclear. A systematic review by U. S. practitioners examined the available literature and found that while routine sterilisation methods often fail to completely remove organic and microbial contaminants from reused HAs, there were no documented reports of adverse clinical outcomes such as implant failure, bone loss, or peri-implantitis directly linked to their reuse[14]. In 2022, Lashkarizadeh et al. conducted a randomised, double-blind clinical trial in Iran comparing unused and reused HAs with respect to peri-implant tissue inflammation. After two months, no significant differences were observed in plaque or bleeding indices, nor in pro-inflammatory cytokine levels (IL-

1β, TNF-α) within peri-implant crevicular fluid[15]. However, the lack of long-term clinical data requires careful consideration in clinical decision-making.

BIOFILM-RESISTANT AND ANTIMICROBIAL SURFACES OF HEALING ABUTMENTS

The development of biofilm-resistant and antimicrobial HAs represents a promising approach to reducing peri-implant infection risk. Silver nanoparticle coatings have been among the earliest strategies explored. In 2020, Japanese researchers Odatsu et al. demonstrated that nanosilver-coated HAs exhibited strong antibacterial effects against oral pathogens in vitro and reduced plaque accumulation in a short-term clinical setting, highlighting the translational potential of metallic nanoparticle coatings[16]. In 2023, Polish researchers investigated "bioactive" HAs designed as local drug delivery devices for peri-implant mucositis, showing favourable modulation of the peri-implant microbial profile in a clinical case series[17]. Recent research has also focused on advanced polymer-based antimicrobial surfaces. Zhou et al. reported the development of titanium HAs modified with dimethylaminohexadecyl methacrylate (DMAHDM), which reduced colony-forming units of *Staphylococcus aureus* and *Streptococcus sanguinis* by several log units and maintained antibacterial activity for over four weeks, the critical period for early implant healing[18]. In addition, in 2023, Iranian researchers Maleki Dizaj et al. examined gelatin–curcumin nanocomposite coatings applied to HAs, confirming in vitro stability and non-cytotoxicity, while suggesting extended release of curcumin could provide antimicrobial benefits during the early healing phase[19]. Innovative surface designs are under investigation. In 2024, Li et al. proposed a coral-inspired therapeutic abutment that integrates polyethylene glycol for self-cleaning and N-halamine chemistry for long-lasting antimicrobial function. Their *in vivo* experiments demonstrated effective biofilm resistance and the ability to reverse early peri-implant infection, while maintaining potential for repeated reuse[20].

Conclusion.

Healing abutments play a crucial role in peri-implant tissue healing but raise significant important concerns when reused. Evidence consistently shows that conventional sterilisation protocols may fail to eradicate biofilm and organic residues, while repeated cycles of use and sterilisation compromise surface integrity and create favourable conditions for bacterial recolonisation. Although current clinical studies do not directly associate HA reuse with implant loss or peri-implantitis, the absence of long-term data underscores the need for caution in clinical decision-making. Innovations such as drug-eluting abutments, antimicrobial coatings, and bio-inspired surface designs represent exciting opportunities to overcome the limitations of conventional HAs. However, these approaches remain largely experimental, and their clinical relevance requires further validation. Until standardised protocols and stronger clinical evidence are available, clinicians must weigh the economic and practical benefits of reuse against potential risks to patient safety and implant success.

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