New Study Finds Tangential Curettage Biopsy May Improve Detection of Microbial Burden in Hard-to-Heal Wounds

Broader and deeper tissue sampling approach may help clinicians reach organisms missed by conventional surface swabs and overcome limitations of focal wound biopsy sampling

Anaheim, Calif. — August 13, 2026 — A newly published peer-reviewed study in the *Journal of Wound Care* reports that a minimally invasive nylon-fabric curettage biopsy technique recovered greater quantities of microbial nucleic acid and, in some patients, materially changed the interpretation of microbial burden when compared with conventional flocked wound swabbing.

The study, **"Comparing flocked swab to nylon fabric curettage brush for the detection of infections in hard-to-heal wounds,"** by Pejman Rahimian, PhD, Mervin Low, MD, and Neal Lonky, MD, MPH, appears in the August 2026 issue of the *Journal of Wound Care*.

The findings raise a broader question in chronic wound diagnostics: **Are clinicians adequately sampling the microorganisms actually residing within the wound bed?**

Biofilm-associated microbial communities in chronic wounds are not necessarily distributed uniformly across the wound surface. Experimental imaging has demonstrated markedly patchy bacterial distributions within wounds, while human tissue studies have shown that bacterial aggregates can occur at different depths within wound tissue. Consequently, the organisms recovered from any diagnostic specimen can depend on both **where** and **how deeply** the wound is sampled.

Sampling the wound—not simply touching its surface

Conventional swabbing remains attractive because it is rapid, inexpensive and minimally invasive. Properly performed Levine swabbing can recover clinically relevant organisms entrapped in the surface fluid and cellular elements, and is considerably better supported than simple superficial or Z-pattern swabbing. Several studies have even found substantial microbiological information can be obtained with well-performed swabs.

However, swabbing and tissue biopsy do not always recover the same microbial communities. Studies using molecular sequencing have demonstrated surprisingly low concordance between paired swab and tissue specimens from the same diabetic foot ulcers, suggesting that different sampling techniques interrogate different microbial compartments of a wound.

Traditional punch biopsy addresses part of this problem by retrieving actual tissue and remains an important reference sampling technique. Systematic reviews have found advantages for tissue biopsy, particularly when quantitative microbial burden or resistant organisms are clinically important. But punch biopsy is invasive, requires appropriate clinical expertise and obtains tissue

from a **small, focal portion of what may be a much larger and biologically heterogeneous wound**.

This creates a potential sampling dilemma: **a surface swab may be broad but relatively superficial, while a punch biopsy may be deep but geographically narrow.**

Tangential curettage offers a different sampling concept

The nylon fabric curettage biopsy device evaluated in the new study is designed to engage the wound surface mechanically and retrieve adherent and subsurface tissue through tangential curettage. Rather than obtaining a single cylindrical core from one location, curettage can sample tissue across a selected area of the wound bed.

This broader tissue acquisition may be particularly relevant to biofilm-associated chronic wounds because microbial communities can exist in discrete aggregates rather than as a homogeneous layer covering the wound. Thus, **sampling a greater area of tissue may potentially reduce the risk of obtaining a specimen from a microbiologically unrepresentative focal site.**

The new study provides preliminary clinical evidence supporting that concept. In eight patients with hard-to-heal wounds, paired specimens were obtained with a conventional flocked swab and the nylon fabric curettage biopsy brush and analyzed using the same validated molecular PCR methodology.

Among the reported findings:

- Pathogen detection concordance between the two sampling methods was only **65%**.
- The curettage biopsy demonstrated **84% sensitivity compared with 81% for the flocked swab**.
- Curettage biopsy specimens produced approximately **30% greater nucleic-acid recovery**.
- **71% of paired targets showed lower PCR cycle-threshold values** with the biopsy brush, consistent with greater recovery of target nucleic acid.
- For **41% of microbial and resistance-gene targets**, the additional material recovered by curettage changed the study's predefined interpretation from a microbial burden consistent with colonisation to one more consistent with infection.
- At the patient level, the sampling method changed the study's infection classification in **50% of patients**.

These findings are particularly notable because the laboratory test was unchanged: **what changed was the specimen presented to the laboratory.**

The emerging issue: diagnostic technology is only as good as the specimen

Modern molecular diagnostics, including quantitative PCR and next-generation sequencing, can identify organisms that conventional culture may fail to recover, including difficult-to-culture and anaerobic organisms. But increasingly sensitive laboratory technology cannot detect microbial DNA that was never captured in the original specimen. Sequencing studies have repeatedly shown that specimen type and sampling location influence the microbial community subsequently identified by the laboratory.

This makes wound sampling an increasingly important component of precision wound diagnostics.

The biological rationale is supported by biofilm research. James and colleagues demonstrated microscopically identifiable biofilm in 60% of chronic wound specimens examined, compared with only one of 16 acute wounds. More recent work has further demonstrated the spatial complexity of wound microbial populations, including bacterial communities occupying limited and patchily distributed regions rather than being evenly dispersed throughout the wound.

Accordingly, a small specimen from a single site may not necessarily characterize the microbiology of an entire chronic wound. **This does not invalidate punch biopsy or swabbing; rather, it highlights the importance of matching the sampling technique to the clinical question.**

A potential bridge between swabbing and focal biopsy

Other investigators have begun exploring tissue scrapings and curettings as less invasive alternatives to punch biopsy. A 2023 study found that tissue scrapings produced during debridement could effectively capture the microbiome of diabetic foot ulcers using both culture and 16S rRNA sequencing, supporting the concept that mechanically acquired tissue can provide diagnostically useful microbial material without requiring a conventional punch biopsy.

The current study extends that concept by evaluating a purpose-designed nylon curettage biopsy device and measuring quantitative molecular recovery against a flocked swab.

“With increasingly sophisticated molecular diagnostics, we have focused enormous attention on what happens after the specimen reaches the laboratory. These findings suggest that equal attention should be paid to how we obtain the specimen in the first place,” said study co-author Neal Lonky, MD, MPH. “A chronic wound can contain microbial communities at different depths and locations. Broad tangential tissue sampling may provide a practical way to interrogate more of that wound environment rather than relying exclusively on material available at the surface or a small biopsy from one focal location.”

Implications for biofilm-associated organisms

The study did not use microscopy to prove that individual organisms detected by PCR were contained within biofilm, and molecular identification alone should therefore not be interpreted as a direct diagnostic test for biofilm.

Rather, the significance of tissue acquisition is that microorganisms associated with chronic wound biofilms may be present within adherent tissue and at subsurface locations that are not consistently represented by superficial sampling. A tissue-acquiring curettage technique may therefore increase the probability that organisms residing within these clinically important microbial niches are included in the specimen submitted for molecular analysis.

The authors describe this as an important area for prospective study.

From “debride and guess” toward “debride, sample and diagnose”

The findings also have implications for antimicrobial stewardship. Identification of microorganisms does not by itself establish clinical infection or mandate antibiotic treatment. Clinical examination, vascular status, wound characteristics and systemic findings remain essential. But when antimicrobial therapy is indicated, obtaining a representative specimen may help clinicians target therapy toward organisms actually present in the wound rather than relying unnecessarily on empiric broad-spectrum treatment.

The study authors emphasize that larger prospective trials are now needed to determine whether broad tangential curettage sampling consistently improves detection of clinically relevant organisms, resistance determinants and treatment outcomes compared with standardized Levine swabbing and focal tissue biopsy.

Device Tip: Biopsy Tissue Filled
SoftBiopsy and Flocked Wound Swab

About the Study

Rahimian P, Low M, Lonky N. **Comparing flocked swab to nylon fabric curettage brush for the detection of infections in hard-to-heal wounds.** *Journal of Wound Care.* 2026;35(8):654–661. doi:10.12968/jowc.2025.0575.

The investigation was a retrospective, blinded paired-sample case series involving eight patients. The nylon fabric curettage biopsy device evaluated in the study incorporates Kylon® fabric and is marketed by Histologics LLC. The manuscript discloses that study co-author Neal Lonky, MD, MPH, is Founder and CEO of Histologics LLC; Pejman Rahimian, PhD, is Laboratory Director at Modus Laboratories and an Assistant Professor at Tarleton State University; and Mervin Low, MD, is CEO of Newport Wound Care. The manuscript states that the research was conducted independently and was supported by non-governmental sources.

Selected Supporting Literature

1. James GA, Swogger E, Wolcott R, et al. Biofilms in chronic wounds. *Wound Repair Regen.* 2008;16(1):37–44. The investigators used microscopic techniques to demonstrate biofilm in 30 of 50 chronic wound specimens, providing foundational evidence that biofilm-associated microbial aggregates are prevalent in chronic wounds.

2. Copeland-Halperin LR, Kaminsky AJ, Bluefeld N, Miraliakbari R. Sample procurement for cultures of infected wounds: a systematic review. *J Wound Care.* 2016;25(Sup4)–S10.

doi:10.12968/jowc.2016.25.Sup4.S4. The review concluded that standardized Levine swabbing is superior to Z-swabbing but also found advantages for quantitative biopsy, particularly when resistant organisms are suspected. It also describes the greater invasiveness and technical requirements associated with tissue biopsy.

3. Travis J, Malone M, Hu H, et al. The microbiome of diabetic foot ulcers: a comparison of swab and tissue biopsy wound sampling techniques using 16S rRNA gene sequencing. *BMC Microbiol.* 2020;20:163. doi:10.1186/s12866-020-01843-2. Paired swab and biopsy samples demonstrated low concordance in microbial composition, illustrating that sampling method can substantially influence which organisms are recovered. Tissue specimens showed greater bacterial diversity, while swabs detected several known or potential pathogen genera at equal or greater frequency.

4. Mahnic A, Breznik V, Bombek Ihan M, Rupnik M. Comparison between cultivation and sequencing based approaches for microbiota analysis in swabs and biopsies of chronic wounds. *Front Med.* 2021. The investigators found substantial differences between culture and sequencing and relatively low swab-biopsy concordance with sequencing, again emphasizing the influence of sampling and analytical methodology on the apparent wound microbiome.

5. Ibberson CB, Barraza JP, Holmes AL, et al. Precise spatial structure impacts antimicrobial susceptibility of *S. aureus* in polymicrobial wound infections. *Proc Natl Acad Sci USA.* 2022;119(51). doi:10.1073/pnas.2212340119. High-resolution imaging in an experimental chronic-wound model demonstrated markedly patchy microbial distribution, with organisms occupying only approximately 5–25% of wound volume and differing spatially between the wound edge and center. Although preclinical rather than human clinical evidence, the study provides strong mechanistic support for the concern that a focal sample may not represent the entire wound microbiology.

6. Travis DJ, Bradbury J, Benkendorff K. Toward non-invasive collection methods for sampling the microbiome of diabetic foot ulcers. *Int Wound J.* 2023;20(9):3731–3737. doi:10.1111/iwj.14267. This study found that tissue scrapings obtained from diabetic foot ulcers could effectively recover clinically relevant microbial communities and specifically proposed tissue scrapings produced during debridement as a minimally invasive source of material for microbiological analysis.

7. Malic S, Hill KE, Hayes A, et al. Detection and identification of specific bacteria in wound biofilms using fluorescence in situ hybridization. The study demonstrated bacterial populations within chronic-wound biopsy specimens using FISH and provided direct tissue-level evidence for biofilm-associated bacterial organization and spatial distribution in chronic wounds.