Wound Exudate Demystified:

What It's Telling You and Why It Matters

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I. Introduction

Wound exudate is one of the most information-rich clinical indicators available during wound assessment. Rather than representing only a problem of excess fluid, exudate provides valuable insight into the underlying wound environment and can reflect healing progression, persistent inflammation, infection, and the effectiveness of current management. Careful evaluation of exudate volume, color, viscosity, odor, and changes over time is therefore an essential component of comprehensive wound assessment. Together, these observations can help clinicians determine whether the wound environment is progressing toward the physiological balance required for healing or whether changes in wound status warrant further evaluation.[1] Exudate assessment can also support shared decision-making by helping clinicians align treatment approaches, dressing-change frequency, and follow-up with patient preferences, access to care, and overall goals of treatment.

Despite its clinical importance, exudate assessment is often performed inconsistently or interpreted in isolation from the broader wound picture. A systematic approach recognizes exudate as a dynamic reflection of the wound environment and considers its characteristics alongside wound etiology, tissue characteristics, the condition of the periwound skin, and patient factors. Integrating these observations supports clinical reasoning, facilitates earlier recognition of changes in wound status, and helps guide appropriate management decisions.[1,2]

This white paper presents a practical framework for interpreting wound exudate in clinical practice. It examines the physiological role of exudate in wound healing, the clinical significance of changes in exudate characteristics, and how these observations can inform dressing selection and ongoing reassessment. By positioning exudate assessment as a core component of wound evaluation, the paper aims to strengthen clinical decision-making, improve patient comfort and well-being through effective exudate management, and support the restoration and maintenance of a balanced wound environment throughout the healing continuum.

II. Exudate in a Balanced Wound Environment

Wound healing is a dynamic process that progresses through overlapping phases of hemostasis, inflammation, proliferation, and remodeling, during which the composition and function of exudate evolve in parallel with the underlying biology.[3,4]

Wound exudate is a normal and essential component of healing with a complex composition similar to blood plasma but enriched with inflammatory and cellular components: wound exudate contains fibrin, proteins, electrolytes, glucose, inflammatory mediators, cytokines, matrix metalloproteinases (MMPs), leukocytes, platelets, and other bioactive molecules that contribute to tissue repair.[5,6] In healing wounds, the coordinated activity of these components helps maintain the physiological conditions necessary for tissue repair. Together, these components help maintain a moist wound environment; facilitate the diffusion of nutrients, growth factors, and immune mediators; support the migration of cells involved in tissue repair; and promote autolytic debridement of devitalized tissue, thereby supporting normal wound healing.[2,7]

As healing progresses, the composition and volume of exudate evolve. Exudate production is greatest during the inflammatory phase, when increased vascular permeability allows inflammatory cells to enter the wound and remove damaged tissue and potential pathogens.[2,4] As inflammation resolves and the wound transitions to the proliferative and remodeling phases, extracellular matrix (ECM) deposition and tissue repair predominate, and exudate volume gradually declines.[2,5] Throughout this process, MMP activity remains tightly regulated, supporting leukocyte recruitment, angiogenesis, re-epithelialization, and ECM remodeling.[3,8] These predictable changes reflect the transition from inflammation to tissue repair and indicate that the wound environment is maintaining the physiological conditions necessary for healing.

When the physiological conditions required for healing are disrupted by persistent tissue injury, microbial burden, or other factors, the coordinated processes of wound repair become dysregulated, preventing normal progression through the healing phases. Complex and chronic wounds typically stall in an inflammatory state characterized by persistently elevated exudate production and an altered biochemical environment.[4,5,7,9] Compared with healing wounds, chronic wound exudate contains increased concentrations of proinflammatory cytokines, reactive oxygen species, and proteases/MMPs, with reduced concentrations of growth factors that support tissue repair.[2,4,9] Excessive protease activity degrades ECM proteins and growth factors, perpetuating inflammation and impairing healing progression.[3,8] These biological differences underscore the importance of interpreting exudate as more than a measure of fluid volume, as changes in exudate characteristics can indicate when the wound environment is no longer supporting normal healing and help guide appropriate management.

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III. Assessing Exudate in Clinical Practice

The characteristics of wound exudate provide insight into the status of the wound environment and provide insight into wound status, making routine exudate assessment an important component of ongoing wound evaluation. The amount and characteristics of exudate should be documented during the initial wound assessment and reassessed over time, with attention to volume, viscosity, color, odor, and changes from the patient's previous presentation.[1] No single finding should be interpreted in isolation, and what constitutes an expected exudate pattern varies according to wound etiology, anatomical location, wound dimensions, healing stage, patient comorbidities, medication use, environmental conditions, activity patterns, and treatment context[2] (Tables 1A and 1B). For this reason, changes in exudate over time are often more informative than a single assessment when guiding clinical decision-making.

Table 1A. Practical Interpretation of Exudate Characteristics

Characteristic	Finding	Potential Clinical Interpretation	Clinical Considerations
Volume	Low	May be expected in epithelializing wounds nearing closure, and in ischemic or arterial wounds and diabetic foot ulcers (DFUs), but unexpectedly low exudate may also reflect dehydration, hypovolemic shock, or excessive moisture removal relative to the wound's needs by the selected dressing system.[2,5]	Interpret relative to wound etiology, perfusion and vascular status, hydration status, dressing selection, and previous assessments.
	Moderate	May be consistent with the expected inflammatory or proliferative response, depending on wound type, wound size, depth, and stage of healing.	Record the amount and type of exudate during the initial assessment and monitor for change over time.[1]
	High or increasing	May reflect inflammation, infection or biofilm, uncontrolled edema, wound size or depth, lower-extremity location, systemic disease, or medication effects.[1,5,7,10]	A sudden increase is generally more clinically meaningful than a consistently high level that is expected for the wound type. Reassess the wound, edema, systemic factors, dressing performance, and signs of infection. Also consider recent activity and treatment changes; initiation or intensification of edema management or compression may temporarily alter exudate volume.

Viscosity and consistency	Thin or watery tissue	May be serous, serosanguineous, sanguineous, seropurulent, or fibrinous.[2]	Interpret with color, odor, wound appearance, treatment history, and changes between visits.
	Thick or viscous	May be purulent, hemopurulent, or hemorrhagic. Increasing viscosity may reflect infection or the presence of immune cells.[1,2,5]	Hydrocolloid and alginate dressings may alter the appearance or consistency of drainage and mimic thick exudate.[2]
Color and type	Serous	Clear, amber, or straw-colored exudate may be expected during the inflammatory and proliferative phases. An increase in serous exudate volume may signal infection.[2]	Evaluate whether the amount is changing or is disproportionate to the wound type and stage of healing.
	Serosanguineous	Clear to pink or light red drainage may be expected during the inflammatory and proliferative phases, after surgery, or following traumatic dressing removal.[2]	During negative pressure wound therapy, drainage may change from serous to serosanguineous, and limited sanguineous drainage may occur because of disruption of capillary buds in granulation tissue.[11] Similar changes may occur with local mechanical irritation or trauma, including traumatic dressing removal.[2]
	Sanguineous	Red drainage may reflect new blood vessel formation, disruption of vessels, trauma, or hypergranulation.[2]	New or increasing sanguineous drainage should be interpreted in relation to recent procedures, activity, dressing removal, wound-bed friability, and bleeding risk.
	Seropurulent	Cloudy, creamy, yellow, or tan drainage may signify infection.[2]	Seropurulent appearance alone should not be considered diagnostic of infection; interpret in the context of wound chronicity, microbial burden, healing trajectory, and other local or systemic signs of infection. Assess for increasing volume, odor, pain, tissue change, and other signs of infection.
	Fibrinous	Cloudy exudate may reflect inflammation with or without infection.[2]	Do not interpret cloudiness alone as diagnostic of infection.
	Purulent	Opaque or milky drainage that may be yellow, tan, brown, or green generally indicates infection; green drainage may be associated with *Pseudomonas*. Purulent exudate may also be malodorous.[2]	Purulent, haemopurulent, and seropurulent exudate may signify infection.[1]
	Haemopurulent	Opaque, milky, reddish or purplish drainage suggests established infection.[2]	Evaluate urgently in the context of tissue deterioration, pain, odor, erythema, and systemic findings.
	Hemorrhagic	Opaque, reddish drainage may reflect infection, or increased capillary friability or trauma.[2]	Differentiate from expected postoperative or post-debridement sanguineous drainage.

Odor	Slight or transient odor	A slight odor may be present in many wounds, and some dressings, including hydrocolloids, have a characteristic odor.[2]	Assess odor after wound cleansing and dressing removal before drawing clinical conclusions.
	Strong, pungent, foul, or persistent odor	Suggests bacterial activity, particularly when accompanied by purulent drainage. Anaerobic organisms most commonly produce malodor, although interactions between aerobic and anaerobic organisms may also contribute.[2,10]	Odor alone should not be used to diagnose infection. Interpret it alongside exudate type, volume, tissue appearance, pain, and other wound-specific infection signs.
	Ammonia odor	Commonly associated with *Proteus* infection.[2]	Consider in the context of complete wound assessment.
Behavior over time	Consistent with previous visits	A healing wound will generally decrease in exudate volume over time; stalled status may suggest improper management, biofilm, or other impairments to healing.	Stable exudate characteristics may indicate a stable wound environment, although lack of improvement should still prompt review of the healing trajectory.
	Sudden increase or change	An increase in exudate or a change in exudate characteristics may indicate infection, but may also reflect changes in systemic health, edema, hydration, treatment, or other patient-specific factors.[11]	Reassess the wound bed, wound edges, periwound skin, pain, odor, edema, systemic factors, treatment effectiveness, and relevant recent changes in activity or routine
	Does not match the wound appearance	Exudate that appears disproportionate to wound size, depth, etiology, or stage may indicate an unrecognized local or systemic factor.	Consider undermining, sinus tracts, edema, infection, fistula, dressing effects, joint involvement and systemic contributors.
Exudate related risk	Expected exudate fluctuation &/or increased exudate risk	Increased likelihood of maceration, dressing failure, treatment disruption, or delayed wound healing (eg, compression, edema, fragile skin, recurrent, leakage, nutritional deficiencies, increasing drainage).[2,12,13]	Consider dressing technologies that provide effective fluid management, retention, and periwound skin protection when exudate-related complications are anticipated.[2,12]

Table 1B. Wound-Specific Considerations When Interpreting Exudate

Wound Type or Context	Expected Exudate Pattern	Changes That May Warrant Attention	Interpretive Considerations
Venous leg ulcers	Often produce relatively high volumes of exudate.[2]	Further increases, leakage, maceration, or failure of volume to decrease may indicate uncontrolled edema, inflammation, infection, or inadequate exudate management.	Further increases, leakage, maceration, or failure of volume to decrease may indicate uncontrolled edema, inflammation, infection, or inadequate exudate management.
Ischemic or arterial wounds	Usually produce relatively low volumes of exudate because of reduced perfusion.[2]	An increase in exudate volume may be a sign of infection in arterial leg ulcers, especially when co-occurring with abnormal odor.[10]	Even limited exudate may be clinically important in a poorly perfused wound. Interpret alongside ischemic pain, tissue necrosis, perfusion status, and signs of infection.
Diabetic foot ulcers	May produce lower amounts of exudate than venous wounds.[2]	Foul odor may indicate infection but may be absent in staphylococcal or streptococcal infection.[10]	Do not rely on odor or exudate volume alone. Neuropathy, ischemia, deep tissue involvement, and muted inflammatory signs may complicate assessment.
Pressure ulcers/injuries	Exudate volume varies according to wound depth, location, tissue damage, inflammation, and infection.	Increasing exudate volume and abnormal odor may indicate infection.[10]	Interpret changes alongside tissue necrosis, undermining, wound depth, periwound inflammation, pain, and systemic findings.
Acute surgical wounds	Serosanguineous drainage may be expected early after surgery and should generally decrease as healing progresses.[2]	Abnormal odor may indicate infection. Persistent, increasing, purulent, haemopurulent, or hemorrhagic drainage warrants reassessment.[10]	Consider the postoperative timeline, surgical procedure, wound closure, drain placement, tissue trauma, and expected drainage pattern.
Full-thickness burns	Burns may normally produce a substantial amount of fluid.	An increase in exudate may be difficult to identify because of the large volume of fluid typically produced.[10]	Changes in color, viscosity, odor, tissue appearance, pain, and systemic status may be more useful than volume alone.
Wounds managed with negative pressure wound therapy	Some blood in low-viscosity drainage may be normally observed with treatment.[11]	Increasing or persistent bleeding, abrupt changes in drainage volume or viscosity, or drainage inconsistent with the wound appearance requires reassessment.	Treatment-related bleeding should be distinguished from clinically significant hemorrhage.
Large, deep, or lower-extremity wounds	May produce greater volumes of exudate because of wound dimensions, anatomical position, local edema, systemic factors, or bacterial colonization.[5]	Exudate that exceeds the anticipated amount or increases suddenly may indicate deterioration, infection, worsening edema, or inadequate dressing capacity.	Interpret the observed volume relative to wound size, depth, location, edema, comorbidities, medications, and treatment plan.

Exudate volume should always be interpreted in relation to wound etiology, healing stage, and patient context (Tables 1A and 1B). Heavy or increasing exudate, as well as unexpectedly low exudate, should prompt reassessment of local and systemic factors before changes in management are made.[1,5,7]

In addition to exudate volume, clinicians should consider factors that influence the impact of exudate on the wound, surrounding skin, and patient's wellbeing. These may include the presence of edema, compression therapy, wound location, periwound skin vulnerability, leakage history, increasing drainage trends, patient mobility, and previous moisture-associated skin damage. Because the consequences of exudate exposure vary among patients and wound types, similar exudate volumes may carry different levels of clinical risk.[2,12-14]

Changes in exudate appearance, including viscosity, color, and clarity, provide additional insight into changes in the wound environment but should always be interpreted within the broader clinical context. Although progression toward thicker, opaque, or purulent drainage may raise concern for increasing inflammation or infection, dressing materials and wound therapies can also alter exudate appearance without indicating clinical deterioration[1,2,5,11] (Table 1A).

Exudate odor should be interpreted alongside other clinical findings. A slight odor may be present in many wounds, and some dressing materials have a characteristic smell; concern increases when odor is strong, pungent, foul, persistent, or accompanied by purulent exudate.[2,10] Odor should be assessed after wound cleansing and interpreted alongside other clinical signs rather than in isolation.

Ultimately, the greatest value of exudate assessment lies in recognizing how multiple exudate characteristics change over time. Unexpected changes should prompt reassessment of the wound, patient, and current management plan. Integrating these observations into routine wound assessment helps clinicians recognize clinically meaningful changes in the wound environment, supports more informed clinical decision-making, and promotes timely intervention.[11]

Case 1. Right second digit arterial ulcer with poorly controlled serous drainage due to being open to air from a displaced band aid.

Case 2. Sero-sanguinous drainage to a left leg ulcer, note bright beefy red granulation tissue accompanying.

Case 3. Sacral pressure injury with purulent drainage poorly controlled due to gauze dressing, resource limitations.

Case 4. Sanguinous drainage to fresh, newly approximated left arm skin tear.

IV. Recognizing Clinically Meaningful Changes in Exudate

Changes in wound exudate are among the earliest clinical indicators that the wound environment is evolving. Within the wound infection continuum, contamination and colonization represent the presence and proliferation of microorganisms without a measurable host response or impairment of healing. As bacterial burden increases, however, wounds may progress to covert local wound infection, during which healing begins to deteriorate before the development of the classic signs of infection.[6] At this stage, increased exudate may precede more overt manifestations such as erythema, swelling, purulent drainage, or malodor and may be accompanied by increased granulation and friability and thus greater likelihood of bleeding, observable in exudate color.[6,15] Because manifestations of infection vary among wound types, exudate changes should always be interpreted within the broader clinical context.[10]

It is important to note that not all clinically meaningful exudate changes are associated with overt infection. Wounds that appear clinically stable but fail to progress despite appropriate management should prompt consideration of underlying biofilm or other barriers to healing. Biofilms are now recognized to be present in most chronic wounds and are believed to contribute to persistent inflammation and stalled healing.[6] Because biofilms may occur deep within the wound bed, they are often difficult to identify through visual assessment alone, and wounds that appear healthy may harbor mature biofilms.[6] Increased or persistent exudate may be one of the few clinical indicators of underlying biofilm and, when healing is stalled, should prompt reassessment of the wound and evaluation of whether current biofilm-based strategies are adequate or require modification.[6]

Collectively, these observations reinforce that exudate should be interpreted as a dynamic clinical signal. Unexpected increases in exudate volume, particularly when accompanied by stalled healing or progressive changes in wound appearance, may indicate that the wound environment is no longer supporting normal healing. Clinically meaningful changes are not limited to dramatic increases in drainage.[1,11] Leakage, recurring periwound maceration, shortened dressing wear time,[2,12] and increasing drainage trends may represent indicators that exudate is no longer being effectively managed, even when overall exudate volume remains moderate.[1,6,11] Many complex wound patients are at increased risk of peri-wound dermatitis due to the many overlapping comorbidities and pharmaceutical exposures of many complex wound patients. Clinicians should offer treatments that can help to mitigate this risk. Early identification of dysfunctional exudate patterns should prompt reassessment of the wound, patient, and current management strategy before more overt signs of deterioration develop[6] (Figure 1).[6,15]

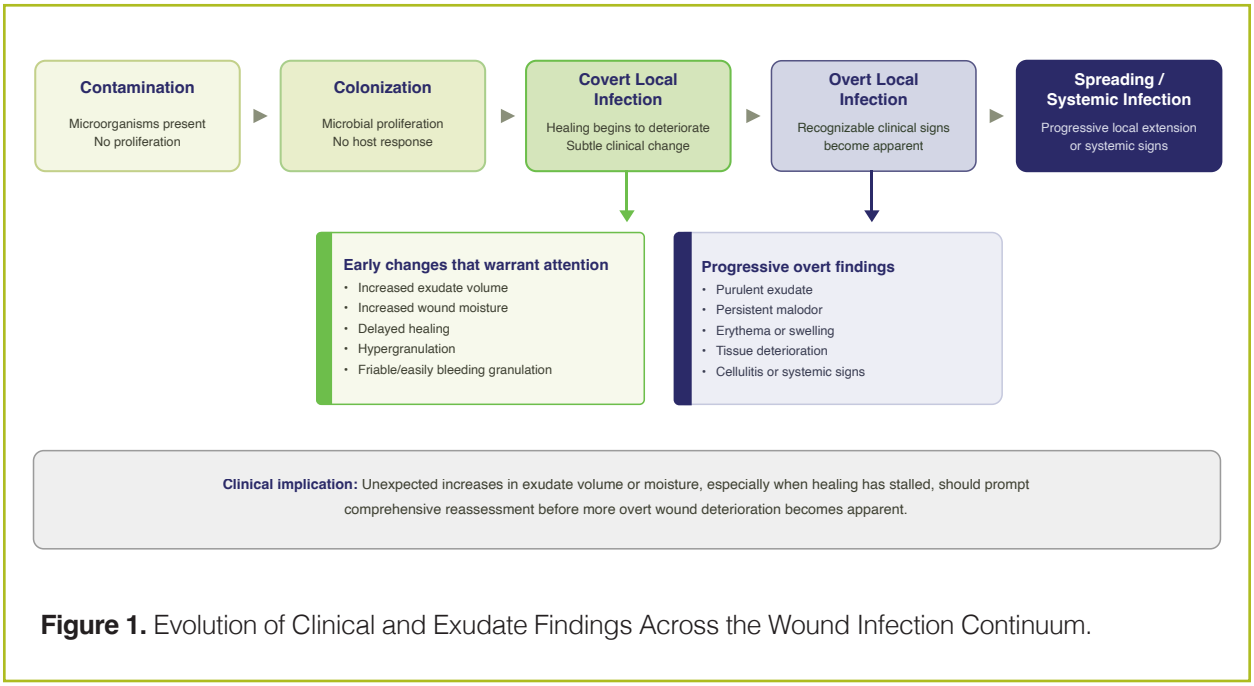

Figure 1. Evolution of Clinical and Exudate Findings Across the Wound Infection Continuum.

Adapted from the International Wound Infection Institute (IWII) wound infection continuum[6] and related guidance (2022).

V. Using Exudate Assessment to Guide Management

Dressings play a central role in exudate management by helping maintain a wound environment that supports healing while minimizing the risk of exudate-related skin damage. The objective of dressing selection for chronic wounds is not simply to remove excess fluid, but to manage exudate in a way that helps restore and maintain a wound environment that supports healing.[7] Both excessive and insufficient moisture can impair healing, damage periwound skin, increase infection risk, and cause pain[1,2,6] and clinicians must continually adjust exudate management to maintain appropriate moisture levels and mitigate these risks.[5] Accordingly, dressing selection should evolve as the wound environment changes and exudate volume and characteristics are reassessed. At the initial decision and subsequent reassessments, clinicians should identify the predominant exudate characteristics and select a dressing whose primary functional properties best address those findings (Table 2).

Table 2. Matching Dressing Functional Properties to Exudate Characteristics

Predominant Exudate Finding	Desired Dressing Function	Representative Dressing Technologies	Clinical Considerations
Dry or minimal exudate	Donate moisture and support autolytic debridement	Hydrogels, hydrocolloids	Appropriate for dry wounds or minimal exudate; avoid in heavily exudative wounds because of maceration risk.[1,7,11]
Low-to-moderate exudate	Maintain moisture balance while providing moderate absorption	Foam dressings, alginates, SAP dressings, hydrofibers	Maintain a moist wound environment while preventing excess fluid accumulation.[2,7]
Moderate-to-high exudate or elevated exudate-related risk	High absorption with effective fluid retention	Complex foams, SAP dressings	Protect the wound and periwound skin by locking fluid away and reducing leakage and strike-through.[5,11]
Highly viscous exudate	Facilitate fluid transport and prevent pooling	Channeled foams, reticulated open-cell foams, NPWT	Products designed for thin exudate may become blocked by viscous fluid, reducing uptake.[1]
Exudate with suspected high bacterial burden	Retain and sequester exudate components while managing bioburden	SAP dressings, select antimicrobial dressings (eg, silver, methylene blue–gentian violet)	Conduct comprehensive assessment to support suspicions of infection and determination of need for antimicrobial therapy.[5,6,15]
Chronic inflammatory exudate with elevated protease activity	Reduce exposure to excessive proteases	ORC/collagen dressings, TLC-NOSF matrix dressings, selected SAP dressings, selected antimicrobial dressings when microbial burden is a contributing factor	Consider when excessive protease activity is suspected to contribute to stalled healing.[1,3,8]
Expected exudate fluctuation and/or increased exudate risk	Maintain moist wound environment throughout dressing fluctuations	SAPs, alginates, hydrofibers	Prophylactic use of higher absorbency dressings especially under compression and with edema, fragile skin, recurrent leakage, increasing drainage, increased maceration risk, dressing failure, treatment disruption, and delayed wound healing

Abbreviations: NPWT, negative pressure wound therapy; ORC, Oxidized Regenerated Cellulose; SAP, superabsorbent polymer; TLC-NOSF, Technology-Lipido-Colloid Nano-Oligosaccharide Factor.

To support a wound environment conducive to healing, modern dressing technologies have evolved beyond simple fluid absorption to actively manage exudate through complementary functions that include absorption, retention, and sequestration. Clinicians should consider these three complementary functional properties when evaluating dressing performance. Absorption refers to the uptake of fluid into the dressing; retention

describes the ability to hold that fluid within the dressing over time and under compression; and sequestration describes the isolation of exudate components away from the wound surface. Gel-forming dressings, including alginates, hydrocolloids, carboxymethylcellulose fibers, and some superabsorbent polymer (SAP) dressings, can trap microorganisms or inflammatory constituents within the dressing matrix while maintaining fluid retention under compression, making for desirable candidates when concomitant compression therapy is used.[2]

Effective fluid retention is particularly important in patients receiving compression therapy, those with edema-related wounds, and those with vulnerable periwound skin, as leakage and prolonged moisture exposure may contribute to maceration, unplanned dressing changes, and disruption of the wound environment if exudate is not adequately contained.[2,12,14,16] In vitro studies further suggest that certain superabsorbent dressings may sequester bacteria within an absorbent core and reduce the activity of host-derived proteases that contribute to chronic wound inflammation, supporting their use in wounds stalled in the inflammatory phase or when high bacterial burden is suspected.[5] Although these functional properties should not determine dressing selection in isolation, they reflect the broader shift toward dressing technologies designed to actively support the wound environment rather than simply absorb exudate. By improving fluid handling and extending wear time when clinically appropriate, advanced dressing technologies may also reduce dressing change frequency and overall resource utilization while supporting wound healing.[11]

Ongoing exudate assessment, including volume, viscosity, color, odor, composition, and changes over time, should directly inform both initial dressing selection and subsequent modifications to the management plan rather than relying on wound type alone.[1] For example, dressings that perform well with thin fluid may become obstructed by increasing viscosity, resulting in pooling at the wound surface and reduced fluid uptake.[1] Leakage from a dressing that is not fully saturated may indicate inadequate retention or poor conformity, whereas a saturated dressing generally suggests that greater absorptive capacity and/or more frequent dressing changes are required.[2] Before modifying the exudate-management strategy, clinicians should confirm that observed moisture or saturation reflects wound exudate rather than contamination from an external or non-wound source. The importance of effective exudate management also extends beyond wound healing itself, as uncontrolled leakage and soiling can negatively affect patient comfort, quality of life, and social functioning.[1]

Because exudate characteristics evolve throughout healing, dressing selection should be viewed as an ongoing process rather than a one-time decision. No single dressing is appropriate for every stage of wound healing, and clinicians should be prepared to escalate or de-escalate exudate management as wound characteristics change.[2]

Reassessment should occur at each dressing change, at intervals appropriate to the wound, and whenever clinical deterioration is observed.[2] Persistent leakage, soiling, increasing exudate volume, worsening odor, periwound maceration, or failure of exudate volume to decrease over time should prompt reassessment of both the wound and the current management strategy, including consideration of underlying factors such as infection, edema, biofilm, or inadequate perfusion. Persistent increases in exudate despite appropriate treatment may indicate treatment failure and may warrant specialist referral or multidisciplinary evaluation.[1] Likewise, failure of wound infection to improve or continued deterioration after 7 to 10 days of treatment should trigger reassessment of the overall management strategy.[15] Routine reassessment of exudate and timely adjustment of dressing selection help ensure that management remains aligned with the changing needs of the wound throughout the healing continuum.

VI. Conclusion

Wound exudate is far more than a byproduct of tissue injury or a determinant of dressing absorbency. Throughout the wound healing continuum, changes in exudate volume, viscosity, color, odor, and behavior over time provide valuable insight into the underlying wound environment and may represent some of the earliest indicators of whether healing is progressing as expected or if reassessment is warranted. When interpreted alongside wound characteristics, patient factors, and serial assessments, exudate becomes a dynamic clinical signal that supports clinical reasoning and informs individualized management decisions.

By shifting the focus from simply managing exudate to understanding what it communicates about the wound environment, clinicians can recognize meaningful changes earlier, tailor interventions more effectively, support patient comfort and individualized goals of care through shared decision-making, and help maintain a wound environment that supports healing over time.

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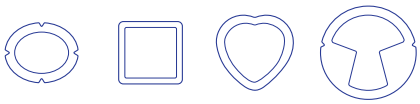

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