

1 **Question 2**

2 **Can biological dressings (e.g., temporary skin substitutes) effectively prevent**
3 **cortical bone necrosis while awaiting definitive flap coverage?**

4 **Background**

5 Exposed cortical bone rapidly desiccates when not covered by vascularized tissue.
6 Progressive drying leads to cortical necrosis, infection, sequestration formation, and
7 compromised reconstructive outcomes. In many trauma settings, definitive flap
8 coverage cannot be performed immediately because of patient instability,
9 contamination, referral delays, or limited reconstructive resources.

10 Biological dressings and dermal regeneration templates have been developed to
11 provide temporary coverage, preserve wound hydration, promote granulation tissue
12 formation, and facilitate later skin grafting or flap reconstruction. Common examples
13 include Integra®, Pelnac®, acellular dermal matrices, ovine extracellular matrix
14 products, and tissue-engineered skin substitutes.

15 The available literature suggests these materials can maintain a favourable wound
16 environment and support vascularized tissue formation over exposed tendon and
17 bone. However, whether they can reliably prevent cortical bone necrosis during
18 prolonged delays to definitive flap coverage remains incompletely established.

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23 **Data Extraction Table**

Author	Design	Sample	Intervention	Key Findings	Follow-up
Iorio et al., 2012	Systematic review	432 patients, 441 wounds	Acellular dermal matrices (Integra, GraftJacket)	Demonstrated successful coverage of exposed bone, tendon, and muscle in acute and chronic extremity wounds; healing rates generally 75–100%	Variable
Lv et al., 2018	Prospective study	16 patients	Pelnac + NPWT + STSG	No infection; 13/16 achieved 100% graft take; satisfactory function and appearance. Pelnac successfully covered exposed bone/tendon wounds.	Mean 16.5 months
Hammer et al., 2017	Pilot study	4 patients	Integra + spray skin + STSG	Allowed successful management of large full-thickness defects and facilitated reconstruction after	Variable

Author	Design	Sample	Intervention	Key Findings	Follow-up
				dermal template integration.	
Mohamed Haflah et al., 2017	Case report	1 patient	MyDerm engineered bilayer skin substitute	Complete wound closure achieved despite large traumatic defect after open fracture and infected fasciotomy.	5 months
Sibbald et al., 2014	Narrative review	Review article	Ovine ECM dressing	Demonstrated extracellular matrix scaffolds may reduce protease activity and support wound healing.	Not applicable

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25 **Results Summary**

26 The available literature consistently demonstrates that biological dressings and
 27 dermal regeneration templates can provide effective temporary coverage for
 28 complex wounds with exposed bone and tendon. Acellular dermal matrices such as
 29 Integra and GraftJacket achieved healing rates ranging from approximately 75% to
 30 100% in extremity wounds and were successfully used over exposed structures.

Pelnac, a bilayer artificial dermis, produced excellent graft take rates and favorable functional outcomes in wounds with exposed bone or tendon.

Similarly, Integra combined with spray skin technology facilitated reconstruction of large traumatic defects while reducing donor-site morbidity.

However, none of the included studies directly measured cortical bone viability or quantified prevention of cortical necrosis. Instead, preservation of wound bed quality, successful granulation tissue formation, and later successful graft or flap reconstruction serve as indirect evidence that these products help maintain tissue viability until definitive coverage can be achieved.

Discussion

The biological rationale for temporary skin substitutes in exposed bone wounds is strong. Cortical bone loses viability when subjected to prolonged desiccation.

Biological dressings act as moisture-retentive barriers and scaffolds for cellular infiltration, angiogenesis, and matrix remodelling.

Among currently available products, Integra and Pelnac have the most clinical evidence. Both function as dermal regeneration templates comprising collagen-based matrices covered by a silicone layer. These constructs promote vascular ingrowth and formation of neodermis, allowing later skin grafting or flap coverage.

The systematic review by Iorio et al. demonstrated successful use of acellular dermal matrices in wounds containing exposed bone, tendon, and muscle, supporting their role as a temporizing strategy.

Nevertheless, the evidence remains indirect. No study specifically compared rates of cortical bone necrosis between biological dressings and standard moist dressings. Similarly, there are no high-quality randomized trials evaluating delayed flap coverage with versus without dermal substitutes.

Consequently, while these products appear biologically plausible and clinically useful for preserving exposed bone and preparing wounds for later reconstruction, **they should not be considered a substitute for timely flap coverage when flap reconstruction is indicated.**

Risk of Bias

Study	Risk of Bias
Iorio et al. systematic review	Moderate
Lu et al. prospective study	Moderate
Hammer et al. pilot study	High
Mohamed Haflah et al. case report	High
Sibbald et al. narrative review	High

Response / Recommendation

Biological dressings and dermal regeneration templates can be used as **temporizing measures** to maintain hydration, promote vascularized tissue formation, and preserve wound-bed quality in wounds with exposed cortical bone

while awaiting definitive reconstruction. However, **current evidence is insufficient** to conclude that they reliably prevent cortical bone necrosis, and **definitive flap coverage should not be unnecessarily delayed.**

Strength of Evidence

MODERATE–LOW

Justification:

- One systematic review available.
- Mostly prospective observational studies, case series, and case reports.
- Consistent positive outcomes across studies.
- No direct measurement of cortical bone necrosis.
- Limited comparative and randomized evidence.