Propolis extract: A new contender for preserving avulsed teeth?

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> Avulsed teeth present a significant challenge in dental trauma, with replantation success critically dependent on the viability of periodontal ligament (PDL) cells. Current storage media offer varying degrees of protection, but none are ideal for maintaining cellular integrity during the extra-oral dry time. A recent study published in Dental Traumatology investigated Thai propolis extract as a novel storage medium, aiming to improve outcomes for these time-sensitive injuries.1

KEY TAKEAWAYS

- The Pivot: Thai propolis extract demonstrated superior preservation of periodontal ligament cell viability and gene expression compared to standard media.
- The Data: Propolis extract maintained PDL cell viability at 90.0% after 6 hours, significantly higher than Hank's Balanced Salt Solution (HBSS) at 70.0% (PThe Action: Clinicians should consider propolis extract as a potential alternative storage medium for avulsed teeth, especially when immediate replantation is not possible.

Successful replantation of an avulsed tooth hinges on the health and quantity of periodontal ligament (PDL) cells remaining on the root surface. These cells are highly sensitive to desiccation and adverse storage conditions, which directly influence the likelihood of reattachment and prevent complications like root resorption. The longer a tooth remains outside the oral cavity without proper storage, the greater the damage to these vital cells, leading to poorer prognoses.1

Current guidelines recommend immediate replantation or storage in specific media like Hank's Balanced Salt Solution (HBSS), milk, or saline. But these options have limitations. HBSS, while effective, is not always readily available in emergency settings, and milk offers only moderate protection. The search for an easily accessible, highly effective storage medium continues to be a priority in dental traumatology.1

Evaluating a Natural Alternative

A team led by Apinya Bunwanna at the Faculty of Dentistry, Chulalongkorn University, investigated Thai propolis extract as a potential storage medium.1 Propolis, a resinous substance collected by bees, possesses well-documented antimicrobial, anti-inflammatory, and antioxidant properties. The researchers hypothesized that these characteristics could translate into superior preservation of PDL cell viability and function. They conducted an in vitro study using human PDL cells to directly compare propolis extract against established storage solutions.1

The study specifically aimed to evaluate Thai propolis extract for its ability to maintain PDL cell viability and preserve gene expressions in PDL tissues. Researchers isolated human PDL cells from healthy premolars extracted for orthodontic

reasons. They then exposed these cells to various storage media: Thai propolis extract at concentrations of 100 µg/mL and 200 µg/mL, HBSS, milk, and distilled water (as a negative control). The cells were stored for 1, 3, and 6 hours at 4°C, simulating typical extra-oral dry times.1

The Numbers on Cell Viability and Gene Expression

Bunwanna and colleagues found that Thai propolis extract significantly outperformed other media in maintaining PDL cell viability. After 6 hours of storage, the 100 µg/mL propolis extract group showed a cell viability of 90.0% (P70.0% viability, and milk, which only preserved 55.0%. Distilled water, as expected, resulted in minimal viability, dropping to 10.0% after 6 hours.1

The researchers also assessed the expression of key genes associated with PDL cell health and function: collagen type I (COL1A1), alkaline phosphatase (ALP), and osteocalcin (OCN). These genes are important markers for the differentiation and regenerative capacity of PDL cells. The propolis extract groups (both 100 µg/mL and 200 µg/mL) demonstrated better preservation of COL1A1 and ALP gene expression compared to HBSS and milk, particularly at the 6-hour mark. OCN expression, a late marker of osteogenic differentiation, also showed better maintenance in the propolis groups.1

The mechanism behind propolis's protective effects likely involves its antioxidant and anti-inflammatory compounds, such as flavonoids and phenolic acids. These components can scavenge free radicals, reduce oxidative stress, and inhibit inflammatory pathways that would otherwise damage PDL cells during ischemia and reperfusion. This protective action is critical for preventing an inflammatory response upon replantation, which often leads to root resorption.1

Comparing Storage Media

The study's findings directly challenge the supremacy of HBSS as the gold standard for avulsed tooth storage. While HBSS provides an isotonic, pH-buffered environment, it lacks the potent antioxidant and anti-inflammatory properties of propolis. Milk, a commonly recommended medium due to its availability and physiological pH, showed significantly lower cell viability and gene expression preservation compared to propolis extract. This suggests that while milk is better than dry storage, it is far from optimal.1

The concentration of propolis extract also played a role. The 100 µg/mL concentration appeared to be optimal, balancing efficacy with potential cytotoxicity. The 200 µg/mL concentration, while still effective, did not offer a statistically significant advantage over the lower concentration and showed a slight, non-significant decrease in viability compared to the 100 µg/mL group at some time points. This highlights the importance of dose optimization for any new therapeutic agent or storage medium.1

This research adds to a growing body of evidence exploring natural products for medical applications. For instance, similar investigations have explored the use of various plant extracts in wound healing and tissue regeneration, often leveraging their anti-inflammatory and antimicrobial properties. The success of propolis in this context aligns with broader trends in biomaterials research, where natural compounds are being re-evaluated for their therapeutic potential. Clinicians often look for readily available solutions in emergency situations, and propolis, if validated in clinical settings, could offer a practical advantage. The microbial environment is always a concern in trauma, and propolis's antimicrobial properties could also be beneficial.

Limitations and Future Directions

The open-label design of this in vitro study is the obvious caveat. While cell culture studies provide valuable mechanistic insights, they do not fully replicate the complex biological environment of the oral cavity. The absence of blood supply, immune response, and mechanical stresses inherent in an in vivo setting means these results require further validation. The study also focused on a single type of propolis (Thai propolis), and the composition and efficacy of propolis can vary significantly based on geographical origin and plant sources.1

The researchers did not investigate the long-term effects of propolis storage on PDL cell differentiation or the potential for root resorption after replantation. These are critical clinical outcomes that an in vivo animal model or human clinical trial would need to address. The potential for allergic reactions to propolis, though generally low, also warrants consideration in a clinical application. The predictive value of animal studies for human outcomes is always a point of discussion, but they would be a necessary next step here.

Still, the data from Bunwanna and colleagues provide a strong rationale for further investigation. The consistent maintenance of cell viability and gene expression markers suggests a genuine protective effect. The relative ease of obtaining and preparing propolis extract, compared to specialized solutions like HBSS, could make it a highly practical option for emergency departments and general dental practices, particularly in resource-limited settings. The Oxford Handbook of General Practice often highlights the need for practical, accessible solutions in primary care settings.

The next step must involve animal studies to assess the efficacy of propolis extract in preserving avulsed teeth and promoting successful replantation in vivo. These studies should evaluate histological outcomes, including the extent of root resorption, ankylosis, and new cementum formation. If positive, human clinical trials would then be warranted to confirm safety and efficacy in a real-world clinical setting. Such trials would need to standardize propolis extract preparation and concentration to ensure consistent results. The potential for neuroadaptation or tissue integration after replantation is a complex biological process that requires careful study.

CLINICAL IMPLICATIONS

The data on Thai propolis extract present a compelling case for re-evaluating our standard approach to avulsed tooth storage. For clinicians in general practice or emergency departments, the prospect of a readily available, highly effective medium that outperforms milk and potentially even HBSS is significant. This could translate directly into better long-term outcomes for patients, reducing the incidence of root resorption and tooth loss. The challenge lies in translating these in vitro results, which showed significantly higher PDL cell viability and gene expression preservation compared to current alternatives, into clinical practice. Before widespread adoption, robust animal and human trials are essential to confirm efficacy and safety. We need to understand the optimal concentration, stability, and potential for adverse reactions in a living system. The dental industry should monitor this research closely; a standardized propolis-based storage solution could become a valuable addition to emergency dental kits.

For patients, particularly parents of children involved in trauma, this research offers hope. An accessible and effective storage medium could mean the difference between saving a permanent tooth and facing complex, expensive restorative procedures. The dry, sardonic reality is that most avulsed teeth are not stored optimally, and any improvement in readily available options is a net gain for patient care.

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