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Subject:
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To:

Abstract

Background
Plastic surgery has long pursued advances in tissue regeneration and healing. In recent decades, adipose tissue has emerged as a rich and accessible source of multipotent stem cells, known as adipose-derived stem cells (ASCs). These cells are commonly administered within the stromal vascular fraction (SVF), a heterogeneous mix of progenitor cells, pericytes, and immune cells obtained from fat tissue. The growing interest in ASCs has driven research into novel fat harvesting techniques, dissociation protocols, and bioengineering applications aimed at optimizing their use in plastic and reconstructive surgery.

Methods
A narrative literature review was conducted using the MEDLINE/PubMed databases, identifying articles published between January 1993 and August 2020. Studies in English, Portuguese, and Spanish were screened for relevance to plastic surgery, stem cell isolation, and tissue engineering. After exploratory reading and analysis, 33 articles were selected for final review. Topics included dissociation techniques, liposuction methods, device development, and translational applications of ASCs.

Results
Of the 33 studies reviewed, 23 utilized enzymatic digestion methods to isolate ASCs, primarily with collagenase-based protocols that remain the current gold standard for high-yield and viability (Zuk et al., 2001; Bourin et al., 2013). Mechanical and non-enzymatic techniques were also reported as promising alternatives that are simpler, faster, and more compliant with regulatory standards for intraoperative use (Shah et al., 2013; Raposio et al., 2014). Liposuction was the predominant fat-harvesting technique used in 25 of the studies, confirming its central role in aesthetic and regenerative procedures (Wu et al., 2020).

Emerging innovations included new mechanical devices for point-of-care SVF isolation (Brown et al., 2017; Doi et al., 2013), along with bioreactor-free protocols for rapid processing. A total of 21 articles explored ASCs integrated into scaffolds or hydrogels for enhanced tissue regeneration, including bone, nerve, and vascular repair (Rath et al., 2016; Park et al., 2014; Chen et al., 2019). Other studies reported the use of ASCs in advanced therapeutic approaches such as exosome delivery, 3D culture systems, and nanomaterial-enhanced grafts, highlighting their versatility and potential clinical impact (Mou et al., 2019; Kim et al., 2015).

Conclusion
Adipose-derived stem cells are proving to be a transformative tool in plastic surgery. Their abundance, ease of harvest, and regenerative capacity make them ideal candidates for cell-based and cell-free therapies. The evolution of dissociation methods—particularly mechanical and enzymatic-free techniques—is expanding opportunities for real-time, intraoperative applications. Concurrently, the integration of ASCs with biomaterials and delivery systems is accelerating progress toward personalized regenerative medicine. Continued research and refinement of isolation technologies, scaffold designs, and regulatory strategies are crucial for transitioning these promising findings into standard surgical practice.

Selected References

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