A Novel Approach to Burn Wound Assessment: Analysis of Cell Packing Behavior in Wound Healing and Regeneration

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Wound assessment is a critical aspect of wound treatment, as the healing progress of a wound determines the optimal approach to care. However, the heterogeneity of burn wounds often complicates wound assessment, leading to inaccurate wound evaluation and ineffective treatment. Traditional wound assessment methods such as Gross Area Reduction (GAR) and Percentage Area Reduction (PAR) are prone to misinterpretation, due to irregular results. Inaccurate wound assessment results in higher rates of death and life-long physical and psychological morbidities in burn patients, especially in low-income communities that lack specialty care and medical resources. Therefore, I propose a novel approach to wound assessment: wound healing from the physical perspective of collective cell migration by analyzing cell packing behavior. This approach was modeled through Voronoi Tessellation simulations and applied to a wound healing system, where changes in the cell morphology parameters of aspect ratio and shape index were plotted over time to numerically evaluate the geometry of different cell migration packing patterns. Experimental results demonstrate the effectiveness of measuring aspect ratio, as a reduction in aspect ratio indicates that cell shapes become increasingly rounded throughout wound closure—this is further proven when considering physical principles in wound healing and changes in cell elongation. By placing a microscope objective on one's phone camera, it is possible to directly examine any wound, with the calculations done on the phone as well. This efficient and accurate mechanism can be especially useful in low-resource communities, as it is accessible regardless of technical or medical background.