

# OrACELL<sup>®</sup> Acellular Dermis

## Analysis of the Acellular Matrix, Growth Factors, and Cytokines Present in OrACELL

Study conducted at Albany Medical Center through funding from the Skin and Wound Allograft Institute, a subsidiary of LifeNet Health

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### Proteins Found in Oracell by Laboratory Analysis

Collagens	GF-binding ECM	Additional ECM	Matrikines	Growth Factors	Cytokines
Type I	Heparan Sulfate Proteoglycan (HSPG)	Elastin	Tenascin-C	BMP6	IL1a
Type III	Chondroitin Sulfate Proteoglycan (CSPG)	Nidogen (Entactin)	Laminins	CTGF	IL1b
Type IV	Perlecan (HSPG2)	Keratin	Decorin	EGF	IL2
Type V	Aggrecan		Endostatin	HGF	IL5
Type VI	Lumican		Pentastatin	PDGFD	IL9
Type VII	Versican		Tumstatin	TGFB1	IL22b
Type VIII	Glypican		Elastokines	VEGFA	IL25
Type XII	Syndecan			VEGFD (FIGF)	IL27
Type XIV	Tenascin (C & N)				IL32
Type XVII	Thrombospondin 2				TNF
Type XVIII	Dermatopontin				
Type XX	Decorin				
Type XXI	Vitronectin				
Type XXIII	Laminin ( $\alpha$ 1-5, $\beta$ 1-3, $\gamma$ 1&3)				
Type XXVII	Fibrinogen (Fibrin precursor)				

### Objective

Identify the extracellular matrix (ECM) components, growth factors, and cytokines in Oracell, a decellularized sterile human dermal allograft.

### Introduction

Human skin is a complex tissue containing various extracellular matrix molecules, growth factors, and cytokines<sup>3</sup>. The purpose of this study was to ensure that Oracell, a minimally manipulated human skin product, retains the components of healthy human skin that make it an effective matrix for soft tissue reconstruction in periodontal defects, ridge augmentation and support for guided tissue regeneration.

*“The results of this study indicate that Oracell retains ECM components, matrikines, growth factors and cytokines consistent with healthy human skin and relevant to the natural repair of periodontal defects.”*



## Methodology

Samples were solubilized in a detergent solution assisted by mechanical homogenization followed by a protein separation based on molecular size. Subsequently, the separated proteins were enzymatically fragmented, after which the amino acid sequence of each fragment was determined by liquid chromatography with tandem mass spectrometry (LC-MS/MS).<sup>1</sup> The amino acid sequences of each fragment were then compared against a database containing the sequences of known proteins to determine the corresponding protein for each fragment. From this comparison, a list of proteins in each sample was generated.<sup>2</sup> This list was mined for extracellular matrix (ECM) components, growth factors, and cytokines to create a table of proteins whose fragments were found in the Oracell sample. Additionally, some components were further verified or identified by immunohistochemical staining and by enzyme-linked immunosorbent assay (ELISA).

## Conclusion

The results of this study indicate that Oracell retains ECM components, matrikines, growth factors, and cytokines consistent with healthy human skin and relevant to the natural repair of periodontal defects.

## Discussion

The environment of the mouth is hostile due to bacteria and the mechanics of mastication. The findings of this study show that the processing of Oracell preserves many of the structural components, growth factors, and cytokines present in healthy human skin. Applying Oracell to periodontal defects can act to replace the damaged and abnormal soft tissue with a minimally manipulated human dermis containing the same wound repairing factors present in natural healthy skin.

Using LC-MS/MS, Oracell was found to contain ECM components present in the native dermis ECM, including collagens, proteoglycans, and elastin.

Additionally, Oracell provides structural integrity and a scaffold for guided tissue regeneration.

The elastikines (cleavage products of elastin) and collagen cleavage products of tumstatin, pentastatin and endostatin are known promoters of cell proliferation and angiogenesis.<sup>4,5</sup>

While cell-secreted growth factors are an essential component of healing, they are not designed to work in isolation but rather intended to be sequestered, regulated, and enhanced by ECM.<sup>3</sup> In harsh environments, increased growth factor expression alone often does not result in increased functional activity.<sup>3</sup>

## OrACELL Provides an Effective Soft Tissue Replacement

The findings suggest that Oracell retains a broad array of extracellular matrix components, matrikines, growth factors, and cytokines present in healthy human skin and can provide the structural integrity needed for periodontal defects and guided tissue regeneration. Only Oracell provides the natural human ECM with greater than 97% of the donor's DNA removed and minimizes the risk of infection with a 10<sup>-6</sup> sterility assurance level.

## What is OrACELL

- Oracell is biocompatible decellularized human dermal allograft with an intact acellular matrix.
- Oracell retains native ECM components, matrikines, growth factors, and cytokines while providing a scaffold for recipient cell proliferation and migration for periodontal defects and guided tissue regeneration.
- Oracell is an effective natural barrier to help resist infection.

## References

1. LC-MS/MS is an analysis whereby the fragmented proteins present in a solution are separated by molecular weight. Then, each separated fragment is further broken into smaller components and the molecular weights of those smaller components is determined. From the molecular weights of the smaller components, the amino acid sequence of the original fragment can be resolved.
2. This analysis was performed by Dr. Qishan Lin at the UAlbany Proteomics Facility.
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4. Tran KT, Lamb P, Deng JS. "Matrikines and matricryptins: Implications for cutaneous cancers and skin repair: J Dermatol Sci. 2005 Oct; 40(1): 11-20
5. Ricard-Blum S, Ballut L. "Matricryptins derived from collagens and proteoglycans: Front Biosci. 2011 Jan 1; 16:674-97

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