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Comparison of
Emcyte CORE Ultrafiltration System – Plasma Concentrator and
Apex Biologix XCELL Protein Concentrator

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Executive Summary

Alpha-2-macroglobulin (A2M) is a large multifunctional plasma protein that is involved in a range of functions including cell migration, proliferation, antigen presentation and removal of cell debris. A2M also functions as a carrier molecule for cytokines and growth factors. In addition, A2M plays a key role as a wide-acting protease inhibitor. Given its large macromolecular structure, A2M prevents proteolytic activity by physically obstructing the interaction of catabolic enzymes and substrates, (ex. collagen) (*Vandooren and Itoh, Front. Immunol. 2021. 12:803244.2021)*. This dampening of protein degradation is thought to be the proposed mechanism of action for A2M-mediated amelioration of diseased or damaged joint symptoms. Through inhibition of proteases (ex. matrix metalloproteases) that breakdown cartilage and through direct interaction with inflammatory mediators (ex. interleukin-1β), A2M may facilitate improvement in symptoms of musculoskeletal conditions (*Sun et al. J Orthop Res. 2023 Jan;41(1):241-248).* A2M is therefore increasingly used in conjunction with platelet-rich plasma as an effective therapy.

This study evaluated two plasma protein concentrating systems – Emcyte Corp's CORE Ultrafiltration System – Plasma Concentrator and Apex Biologix' XCELL Protein Concentrator. Both concentrators function via removal of water using filtration fibers that facilitate the concentration of plasma macromolecules including alpha-2-macroglobulin (A2M).

Results:

The CORE Ultrafiltration System – Plasma Concentrator produces a 5.6mL plasma protein concentrate with an average A2M concentration of ~7500µg/mL and 86% A2M recovery. The XCELL Protein concentrator produces a 5.4 mL plasma concentrate with ~4300 µg/mL A2M concentration and 66% A2M recovery. The Emcyte CORE hemoconcentrator produces a plasma protein concentrate which is more concentrated and returns a greater A2M yield compared to the Apex Biologix XCELL concentrator.

Introduction

Alpha-2-macroglobulin (A2M) is a large multifunctional plasma protein that is involved in a diverse range of biological processes including regulation of protease activity, anti-inflammatory cytokine signaling and growth factor activity. In this study, the concentrations of A2M protein in plasma concentrate products prepared using the Emcyte CORE Ultrafiltration System – Plasma Concentrator and the Apex Biologix XCELL Protein Concentrator were compared.

Study Design:

Up to 60mL of human whole blood was drawn from donors following informed consent. The consent form and blood collection protocols are approved by the WCG Independent Review Board. Platelet poor plasma was prepared by centrifugation of citrated whole blood. 20 – 25 mL of platelet poor plasma (PPP) from each donor was applied to each plasma concentrator device (Emcyte n = 7; Apex n = 2). Plasma proteins were concentrated according to manufacturer's instructions for use. Briefly, each concentrator has 3 ports to which 3 syringes are attached. Two syringes were used to flush PPP back and forth across the concentrator, while the third syringe collected the effluent (water) produced during the concentration process. Aliquots from the PPP (baseline) samples and plasma concentrate samples were collected and stored at -80°C until analysis. A2M concentration was determined for each sample by enzyme linked immunoassay (ELISA) testing and A2M recoveries were calculated.

Summary of Results:

The CORE Ultrafiltration System – Plasma Concentrator produces a concentrate of ~5.6 mL on average, while the Apex XCELL concentrator produces a 5.4mL concentrate. The Emcyte CORE protein concentrate had a higher average A2M concentration of 7481 µg/mL, compared to the Apex XCELL concentrator which had an average A2M concentration of 4291 µg/mL. A significant majority of plasma A2M was recovered post-processing using the Emcyte CORE device with an average yield of 86%. The average A2M recovery using the Apex XCELL device was 66%. The Emcyte CORE and Apex XCELL products had A2M concentrations that were 3.7x and 2.5x greater than baseline A2M concentration, respectively.

Protein Concentrator	A2M Concentration (µg/mL)	A2M Recovery (%)	A2M Concentration Factor (x baseline)
Emcyte CORE	7481 $\pm$ 2082	86 $\pm$ 7	3.7 $\pm$ 0.6
Apex XCELL	4291 $\pm$ 31.4	66 $\pm$ 1	2.5 $\pm$ 0.02

Results

Table 1. **Plasma Volumes (mL)**

Samples	**PPP (Baseline)** (mL)		**Protein Concentrate** (mL)	
	Emcyte CORE	**Apex XCELL**	**Emcyte CORE**	**Apex XCELL**
Mean	**23.8**	**20**	**5.6**	5.4
St Dev	2.4	-	0.7	0.05

Table 2. **Alpha-2-Macroglobulin Concentration (µg/mL)**
Normal blood levels of A2M (1000 – 3000 µg/mL)

Samples	**PPP** (µg/mL)		**Protein Concentrate** (µg/mL)	
	Emcyte CORE	**Apex XCELL**	**Emcyte CORE**	**Apex XCELL**
Mean	**2025**	**1732**	**7481**	**4291**
St Dev	514	30	2082	32

Table 3**. Alpha-2-Macroglobulin Recovery and Concentration Factor**

Samples	**A2M Recovery** (%)		**A2M Concentration Factor** (x baseline)	
	Emcyte CORE	**Apex XCELL**	**Emcyte CORE**	**Apex XCELL**
Mean	**86%**	**66%**	**3.7**	**2.5**
St Dev	7%	1%	0.6	0.02