

Hyaluronic Acid Rheology

Unresolved Questions About Viscosupplementation

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Unresolved Questions

- * Study 1: Does the needle size modify the rheological properties of mannitol-modified hyaluronic acid viscosupplements?
- * Study 2: Does skin disinfection with a quaternary ammonium salt impact the rheological properties of mannitol-modified hyaluronic acid viscosupplements?

MATERIAL

- * HAppyCross[®]: cross-linked HA (16 mg/ml)
- * HAppyVisc[®]: linear HA (15,5 mg/ml ; MW: 1-1,5 MDa)
- * Both combined with high concentration of mannitol (35 mg/ml)
- * Cone-plate rheometer: RheoWin HAAKE Viscotester iQ Air (Thermo Electron SAS)

METHOD

- * The dynamic viscosity η was measured in triplicates according to the shear rate $\dot{\gamma}$ from 0,1 to 100 s^{-1} at 20°C

Study 1

Does the needle size modify the rheological properties of mannitol-modified hyaluronic acid viscosupplements?

Study 1 - MATERIAL

- * **21G x 1,5'' L40 mm** (BD Microlance™ 3): recommended needle



- * **22G x 3,5'' L90 mm** (BD Spinal Needle™): very long needle

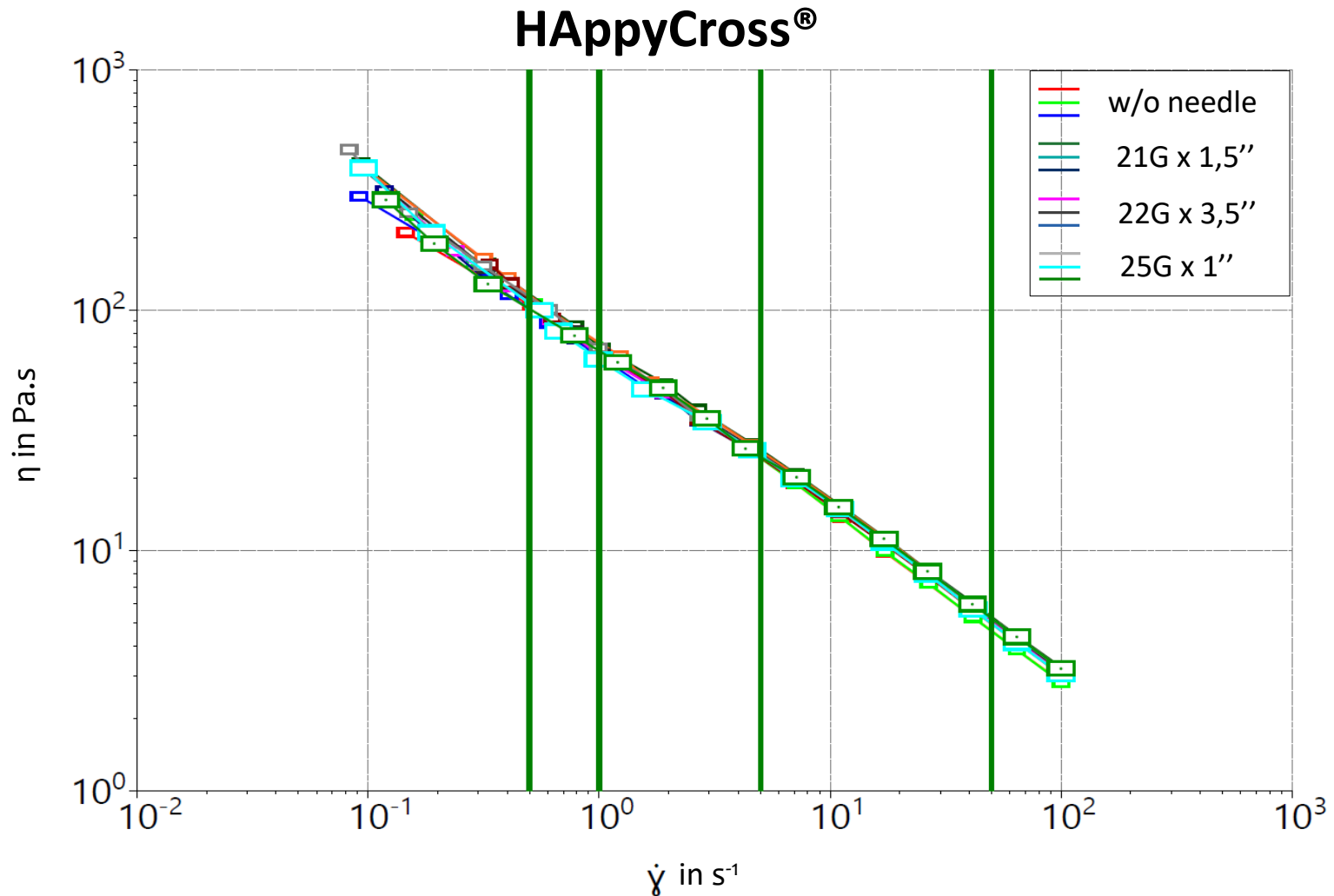


- * **25G x 1'' L25 mm** (Terumo Europe K-Pack II Needle): needle with a very small diameter



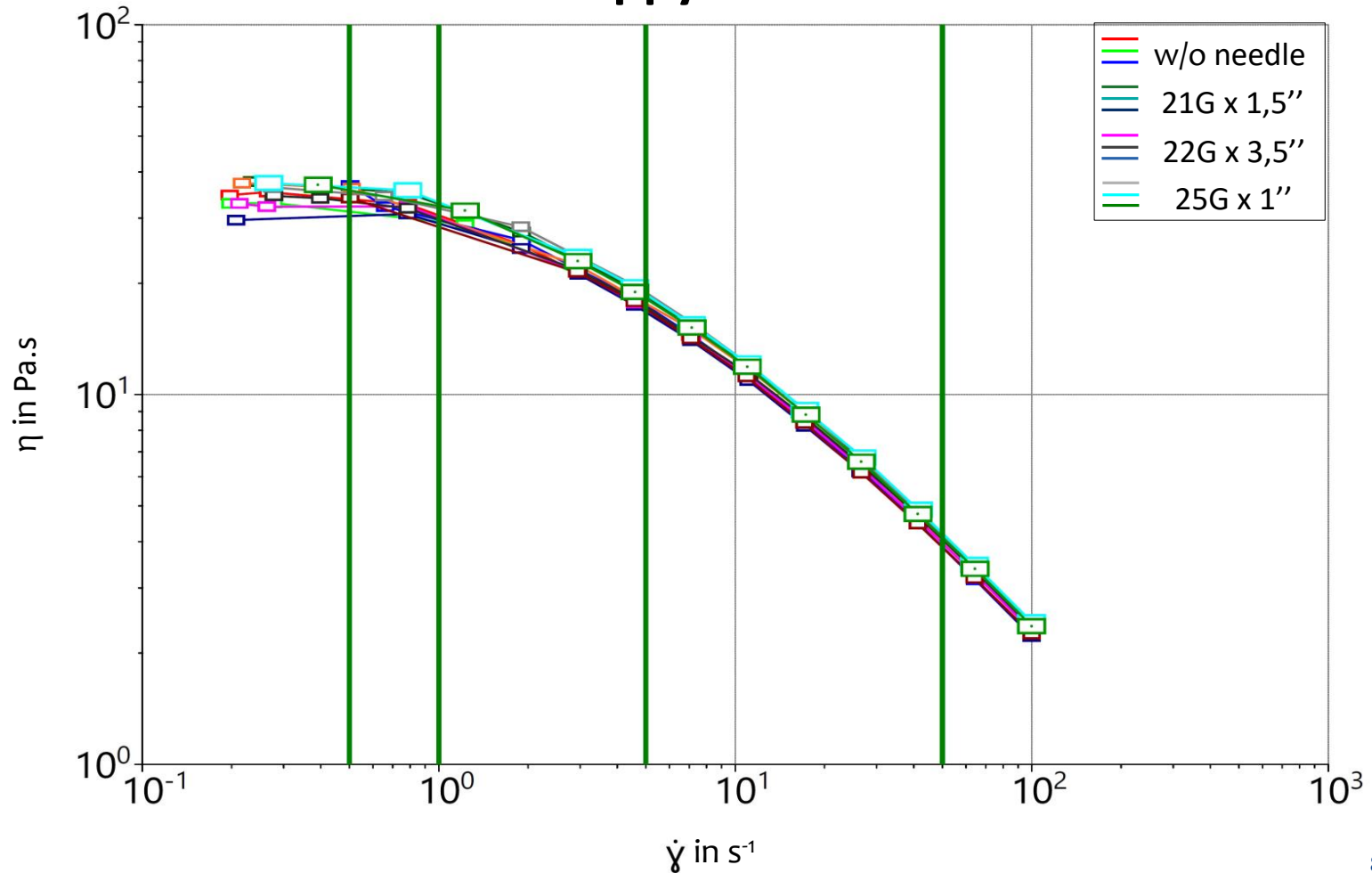
- * Without needle as control

Study 1 - RESULTS



Study 1 - RESULTS

HAppyVisc®



Study 1 - RESULTS

		w/o needle	21G x 1,5'' L40 mm	22G x 3,5'' L90 mm	25G x 1'' L25 mm	p-value
HAppyCross®	Mean η (Pa.s) $\gamma = 0,5 \text{ s}^{-1}$	104,5	110,8	108,2	107,2	0,79
	SD	3,8	9,2	2,7	7,1	
	Mean η (Pa.s) $\gamma = 50 \text{ s}^{-1}$	4,7	5,2	5,0	5,1	0,84
	SD	0,3	0,1	0,2	0,1	
HAppyVisc®	Mean η (Pa.s) $\gamma = 0,5 \text{ s}^{-1}$	33,9	34,2	33,2	34,6	0,91
	SD	2,7	4,1	4,0	2,6	
	Mean η (Pa.s) $\gamma = 50 \text{ s}^{-1}$	4,0	4,1	4,0	4,2	0,98
	SD	0,1	0,2	0,1	0,1	

* The dynamic viscosity η is not statistically modified according to the needle length and diameter.

Study 1 - CONCLUSION

- * The needle length and diameter do not modify the rheological behaviour of HAppyCross[®] and HAppyVisc[®]
- * Viscoelastic properties depend on both HA MW and concentration
- * The HA concentration is not modified → HA is not depolymerized during viscosupplementation, regardless of the needle characteristics

Study 2

Does skin disinfection with a quaternary ammonium salt impact the rheological properties of mannitol-modified hyaluronic acid viscosupplements?

Study 2 - MATERIAL

- * Pork skin



- * 21G x 1,5'' L40 mm (BD Microlance™ 3)



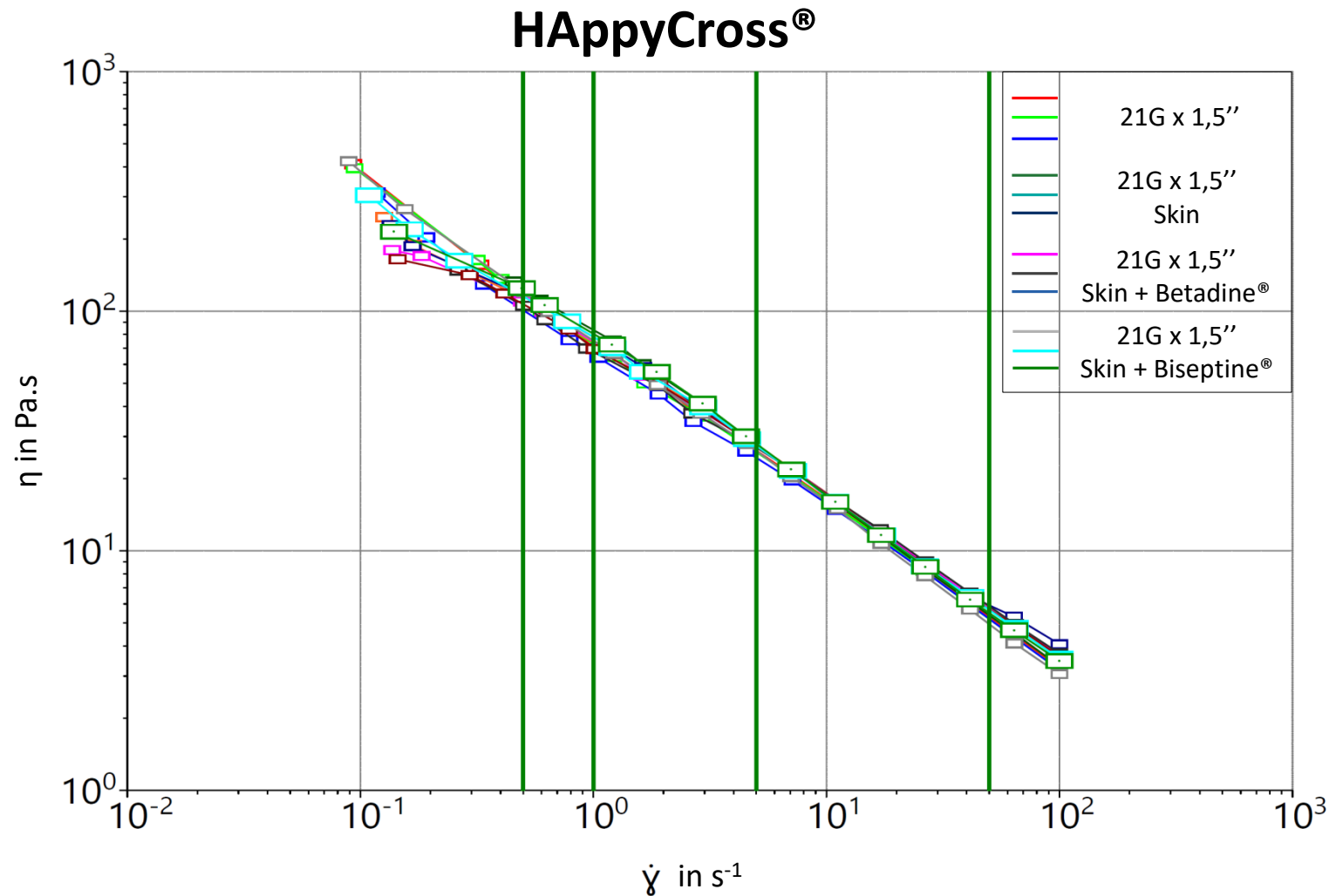
- * **Biseptine**®: antiseptic from the family of quaternary ammonium salts



- * **Betadine**®: iodinated derivative

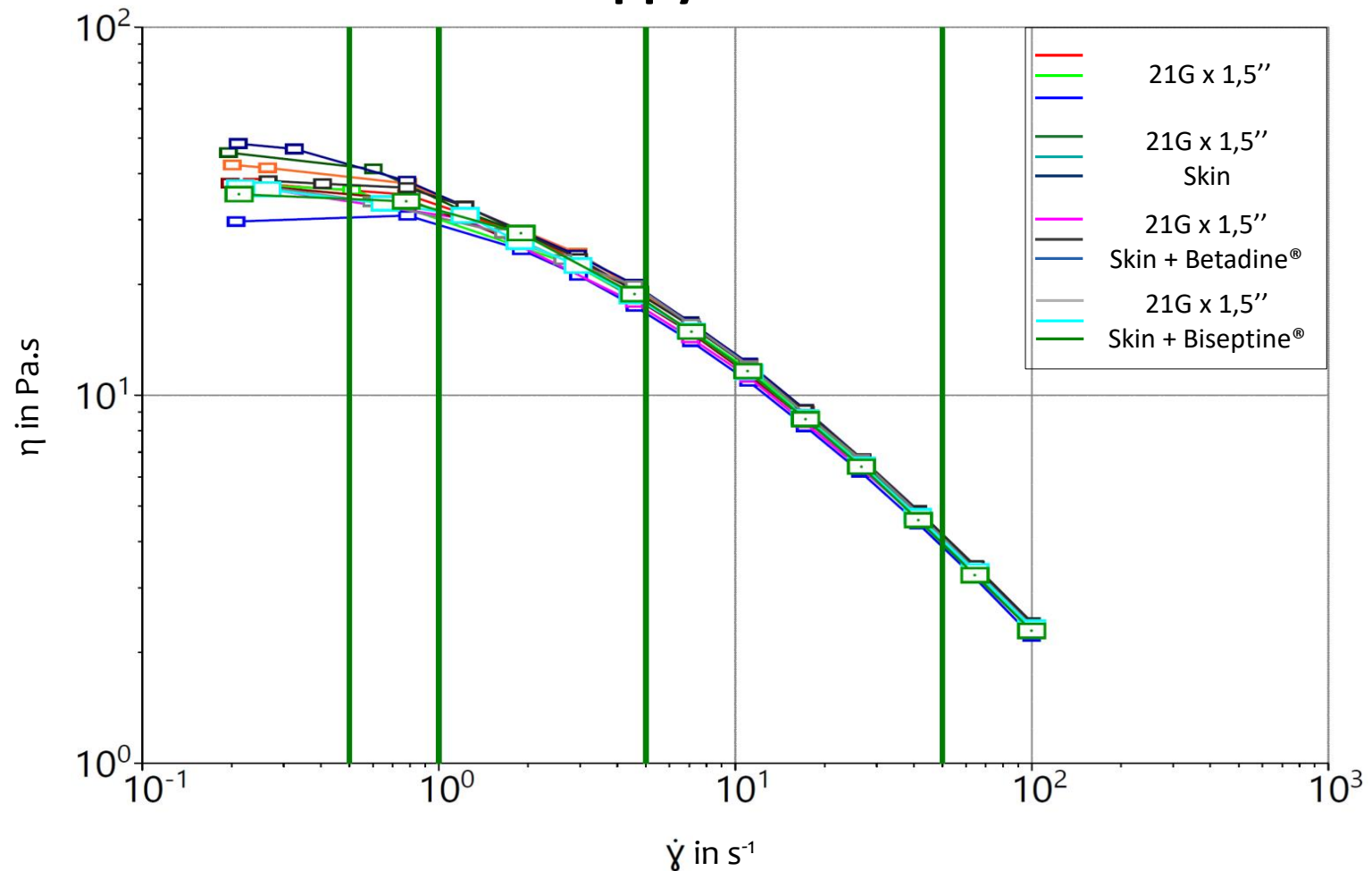


Study 2 - RESULTS



Study 2 - RESULTS

HAppyVisc[®]



Study 2 - RESULTS

		needle alone	needle pork skin	needle pork skin Betadine®	needle pork skin Bispetine®	p-value
HAppyCross®	Mean η (Pa.s) $\gamma = 0,5 \text{ s}^{-1}$	110,8	118,2	106,8	119,4	0,84
	SD	9,2	5,9	2,8	4,9	
	Mean η (Pa.s) $\gamma = 50 \text{ s}^{-1}$	4,7	5,2	5,0	5,1	0,81
	SD	0,1	0,3	0,1	0,4	
HAppyVisc®	Mean η (Pa.s) $\gamma = 0,5 \text{ s}^{-1}$	34,2	41,2	35,4	33,8	0,61
	SD	3,3	1,7	1,8	0,1	
	Mean η (Pa.s) $\gamma = 50 \text{ s}^{-1}$	4,1	4,2	4,1	4,0	0,97
	SD	0,2	0,1	0,1	0,1	

* The dynamic viscosity η is not statistically modified according to the disinfection protocol.

Study 2 - CONCLUSION

- * The rheological behaviour of HAppyCross® and HAppyVisc® is not impacted when an antiseptic from the family of QAS is used to disinfect the injection site before viscosupplementation
- * Viscoelastic properties depend on both HA MW and concentration
- * The HA concentration is not modified → No structural change of the HA macromolecule

END

Thank you !



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