Comparing the hyaluronan content of fascia at Centers of Coordination (CCs) and non-CCs

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Introduction
Centers of coordination (CCs) are specific points where the mechanical forces converge in epimysial fascia to coordinate the movement of a joint in a specific plane of motion. It is known that the loose connective tissue between layers of fascia are rich in hyaluronan (HA)\(^1\), allowing normal gliding of the fascial layers. Densifications in the fascia are described as areas of increased concentration of HA molecules\(^1,2,3\), causing a polymerization of the HA chains. This entanglement of the HA chains causes a change in the consistency of the HA\(^4\), causing a restriction in the fascial gliding, leading to dysfunction and pain\(^1,3\). Although previous studies used un-embalmed cadavers to study fascia, this study attempts to identify and examine the HA content in CCs and non-CCs using embalmed cadaver tissue\(^5\).

Methods
Before dissection the known Centers of Coordination (CC) were palpated in the left lower extremity of an embalmed cadaver. A density within the tissue of the mid-thigh, above the short head of the biceps femoris and IT band, consistent with a CC was identified. The skin was marked above the palpable density before a broad section of muscle and fascia were dissected out of the cadaver, laid out on a flat surface and palpated again to confirm the density was within the dissected tissue. The density was sectioned out of the larger piece of dissected muscle. An adjacent portion of non-densified muscle and fascia was also sectioned.
A second density within the tissue of the proximal, lateral thigh, over the tensor fasciae latae muscle and fascia was also sampled using the same methods along with an adjacent portion of non-densified tissue.
These tissues were submitted for routine, FFPE processing at Marshfield Laboratories. All tissues were sectioned and stained with H&E. Special stains were performed to examine histological properties of densifications and non-densified tissue and fascia. Alcian Blue, ph 2.5 and Colloidal Iron, treated and untreated were performed on these sections. Two additional slides were stained with a Colloidal Iron procedure, one slide was first treated with hyaluronidase to digest out hyaluronan and the second slide was left untreated before both were subsequently stained with Colloidal Iron.

Results

Colloidal Iron is a stain that demonstrates acid mucopolysaccharides and sialomucins deep blue and the nuclei and cytoplasm are counterstained pink-red (Fig 1,2). Treatment of slides with hyaluronidase digests out hyaluronan prior to Colloidal Fe staining (Fig 3). Absence of deep blue staining in areas stained deep blue in the untreated slide confirm that the substance stained and digested is in fact hyaluronan. Stained sections of densified CCs stained bright blue with Colloidal Iron without the digestion technique and from the same tissue treated with hyaluronidase demonstrate an absence of this blue staining confirming this substance to be hyaluronan. Sections from adjacent, non-densified tissues showed dramatically lower levels of blue staining in both treated and untreated sections.
Hyaluronan is an acid mucopolysaccharide that stains with Alcian Blue specifically at a pH of 2.5. Sections of densified CCs stained pale blue consistent with hyaluronan and adjacent, non-densified tissues stained a much paler blue (Fig 4).

Conclusion
This study demonstrated that there is an increased quantity of hyaluronan present in Centers of Coordination that were identified to be densified via palpation. This study also demonstrated the quantity of hyaluronan present to be substantially less prevalent in adjacent tissues identified as non-densified via palpation.

References