Wharton’s Jelly

The human umbilical cord is composed of an outer layer of tissue surrounding a vein and two arteries embedded within a mucoid connective tissue. The mucoid connective tissue enclosing the three umbilical vessels is known as “Wharton’s Jelly.” It was first described by Wharton in 1656, and is primarily made of collagen and proteoglycans which are proteins found in connective tissue. McElreavey in 1991 found that Wharton’s Jelly provides a source of mesenchymal stem cells (MSCs). Wang et al., in 2004 provided the evidence that Wharton’s Jelly cells can be classified as mesenchymal stem cells.

Discovered in the early seventies, MSCs were first isolated from bone marrow by Friedenstein et al. MSCs have been isolated from various tissues including adult bone marrow, adipose tissue, and liver, as well as fetal/perinatal sources such as umbilical cord blood, placenta, and umbilical cord matrix (Da Silva Meirelles et al., 2006; Ma et al., 2014). MSCs have a broad differentiation potential meaning they can become various tissue types.

Wharton's Jelly MSC have several advantages over adult MSCs. They are easily isolated from the umbilical cord which is readily available and discarded at birth. Unlike bone marrow MSCs which require an aspiration, the isolation of Whartons Jelly MSCs is non-invasive. Several reports have shown a relatively high expression of pluripotency markers in Wharton's Jelly MSCs compared to MSCs from other sources (Fong et al., 2011; El Omar et al., 2014).

Originally, MSCs were thought to mediate tissue and organ repair by the virtue of their potential to replace damaged cells (Mahmood et al., 2003; Murphy et al., 2003). Subsequent studies have shown that in response to tissue injury, MSCs are drawn to the site of damage and encourage repair through the production of factors such as growth factors, cytokines, and antioxidants (Chen et al., 2008; Karp and Leng Teo, 2009). Before carrying out tissue repair functions, MSCs are believed to first prepare the microenvironment by modifying inflammatory processes and releasing various growth factors in response to the inflammation status (Ma et al., 2014).
The clinical benefits of MSCs are related to several important biological properties: the ability to target sites of inflammation following tissue injury; the secretion of multiple bioactive molecules capable of stimulating recovery of injured cells and inhibiting inflammation; modulating immune functions (Anzalone et al., 2018), and differentiation into various cell types (Wang et al., 2012).
A recent study by Gupta, et al. in *Journal of Orthopaedic Surgery and Research* 2020, revealed there are numerous growth factors, cytokines, hyaluronic acid, and extracellular vesicles present in Wharton's Jelly. The amount of these factors in Wharton's Jelly is higher compared with other biologics and may play a role in reducing inflammation and pain and augment healing of musculoskeletal injuries.

Theoretically, Wharton's Jelly should provide an orthobiologic with ideal properties to facilitate pain relief, inflammation, and healing. At this time, more studies are needed to prove its clinical benefit.

Wharton's Jelly is an evolving and often effective treatment option. Although Wharton's Jelly is not 'FDA-approved,' it can be legally used 'off label' for musculoskeletal conditions. This procedure is considered experimental, investigational, non-covered, or not medically necessary by insurance companies. Patients are financially responsible for the cost of this procedure.