## Introduction

### Umbilical Cord Tissue: A rich source of multipotent human stem cells with excellent potential for a diverse range of regenerative medicine therapeutics

It is now widely reported and accepted that the connective tissue and vasculature from the umbilical cord contains a population of highly proliferative human progenitor/stem cells. These cells have been reproducibly demonstrated to exhibit differential potential (osteogenic, chondrogenic, adipogenic Fig 1.0) under strict stimuli conditions. This population of cells have been described to be characterised by a defined set of cell surface markers. These cells were shown to be immunologically incompetent and are increasingly reported to be a viable source of multipotent cellular material for a growing number of cell based therapies. These cells for the purpose of this document will be referred to as umbilical cord derived mesenchymal stem cells. Given the overwhelming and growing scientific evidence Smart Cells have now launched a new service which offers the procurement, processing and efficient cryopreservation of umbilical cord tissue as a precious source of autologous human adult mesenchymal stem cells in addition to umbilical cord blood stem cells.

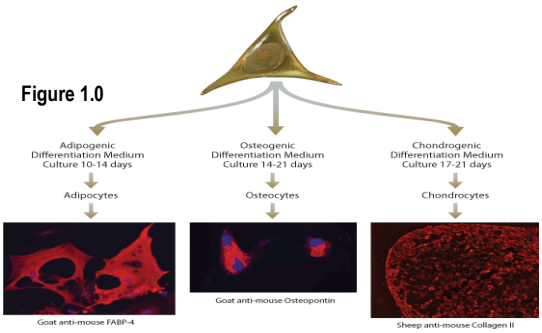

Figure 1.0

Umbilical cord stem cells are reportedly more superior compared to the other sources of adult stem cells, since the ability of stem cells to multiply and differentiate decreases with increasing donor age. In addition umbilical cord MSCs are reportedly more advantageous in that they show reduced immune responses and faster rates of division i.e. the capacity of MSCs to proliferate. MSCs exhibit high plasticity (ability to become different cell types), and have been shown to differentiate into bone, cartilage, nerve, adipose, cardiac, smooth muscle, hepatic and skin cells and are therefore extremely promising in regenerative medicine.

MSC stem cells are different type of stem cell from those collected from the umbilical cord blood that is referred to as hematopoietic stem cell or simply HSC. There are a growing number of clinical trials across a range of disease types that are studying the safe and effective use of MSC where other treatments are either ineffective, palliative or simply do not exist.

Due to their immunomodulatory action (avoid causing an immune reaction), co-transplantation of MSCs with hematopoietic stem cells (from the cord blood), reduces the probability of rejection of partially compatible hematopoietic stem cells in allogeneic transplantations. MSCs have also received significant interest for their role in the treatment of chronic autoimmune and inflammatory conditions, such as Rheumatoid Arthritis and Crohn's disease. Current phase I and II clinical trials are under way for the clinical use of MSCs for the treatment of multiple sclerosis. In addition, recent tissue engineering studies with MSCs have successfully given rise to artificial valves and capillaries. And finally, they are currently being tested as delivery vehicles in the context of gene therapy for the delivery of anti-tumour agents for cancer treatments. The future of MSC based therapy appears very promising indeed!

MSCs have a wonderful characteristic feature that is referred to as ‘immune privileged status’. This means that the cells essentially evade the host immune system (through various mechanisms) and do not cause an immune response if used for allogeneic transplantation.

Theoretically this means that the cells can be used for any family member and potentially any non-related individuals. This is currently the subject of a huge number of clinical trials worldwide.

Using proven and tested scientific technology, Smart Cells scientific team have developed a procedure that allows the safe and effective procurement of cord tissue. The cord tissue is transported back to the Laboratory where it is processed, and stored in multiple aliqouts to allow potentially multiple uses for the client in the future. Smart Cells scientific team are performing on going studies to ensure the cord tissue MSCs are cryopreserved for long term storage Fig 2.0.

In accordance to the current scientific opinion, we at Smart Cells International firmly believe that storing the whole umbilical cord tissue cell population and not a distinct subset of it, is the safest and most reliable way to store not only the mesenchymal stem cells, but other potentially valuable stem cell populations for which we have no current knowledge. The science around the processing of cord tissue is still relatively in its infancy. The rationale for not isolating the cells from the tissue is based on the idea that the scientific community is not united in the anatomical location from which to isolate the cells. Some scientists indicate the vasculature of the cord, whilst many others indicate the whartons jelly (Fig 3.0). In addition, the cord may also contain other types of stem cells, and if we process the tissue to remove only the MSCs, we are potentially discarding other important cells such as Endothelial Progenitor Cells (EPCs), which have been identified in the cord blood but may also have origins within the cord tissue too.

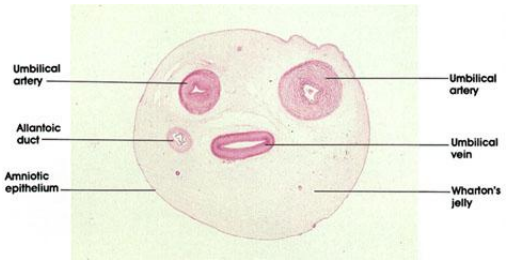


Figure 3.0

**Conclusion**

The umbilical cord tissue is now considered a viable, easily accessible and credible source for human adult stem cells. The procurement, processing and long term storage using advanced scientifically developed cryopreservation technologies is an important step forward to allowing individuals the choice to store their child's stem cells for any future or immediate use. The cryopreservation of whole tissue using developed cryopreservation protocols is an effective solution. The continuing growth in clinical trials worldwide that are studying, validating and implementing the clinical application of MSC based therapy supports this exciting and new service offered by Smart Cells.

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