Universität Rostock

Traditio et Innovatio

Analysis of the Water Jet of a Lipo-suction Device

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Introduction

The method of water-assisted liposuction (WAL) is capable of gentle extraction of human fatty tissue with the use of a specifically fan-shaped water jet. Associated with it is the obtention of adipose derived stem cells (ADSC). A novel WAL-device with compact dimensions for the extraction of small quantities of ADSC for tissue engineering application is investigated. This is done in cooperation with human med AG, Schwerin, Germany. Accordingly an experimental setup for the analysis of the water jet of the novel WAL-device (human med body jet® eco) and an established WAL-system (human med body-jet® evo) was developed.

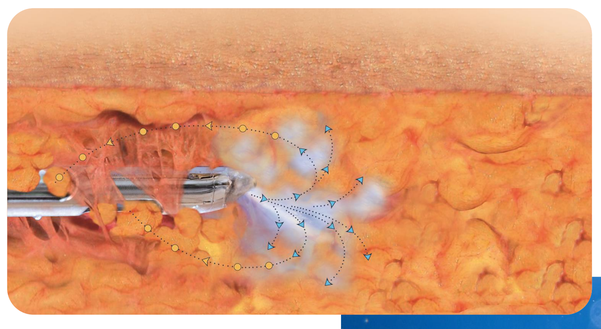

Fig. 1. The fan-shaped water jet infiltrates the human fatty tissue, which will be extracted by extraction holes right afterwards

Fig. 2. Fan-shaped water jet of a WAL-cannula in detail

Methods

The experimental setup uses a piezoresistive cantilever as a force sensor (type: ME Messsysteme KD45 2N). The WAL-cannula consists of a nozzle and a curved plate to shape the water jet. The effect of shaping the water jet is investigated. Specifically designed sensor heads allow for analysing either the complete or the partial cross-section of the water jet. To ensure precise positioning of the cannula of the WAL-device in front of the sensor head, a fine adjustment screw is used. The pressure of the water supply is created by a plunger pump and is controlled by the WAL-device.

Fig. 3. WAL-cannula: (1) integrated nozzle, (2) curved plate to shape water jet

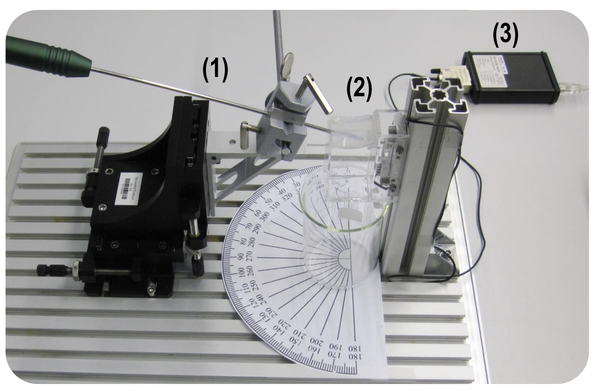

Fig. 4. Experimental setup: (1) cannula positioning, (2) force sensor setup, (3) measuring amplifier

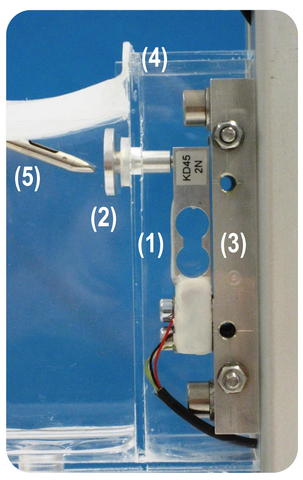

Fig. 5. Force sensor setup in detail:
(1) force sensor,
(2) sensor head,
(3) sensor mount,
(4) protective enclosure,
(5) WAL-cannula in front of sensor head

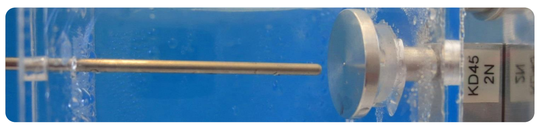

Fig. 6. Nozzle of a WAL-cannula in front of sensor head; the curved plate was removed before measure-ment

Results

An experimental setup for the analysis of the water jet was successfully established. Measurements were taken from the complete cross-section of the water jet of established WAL-devices. As expected there is a linear relationship of the impact force of the water jet and the pressure in the water supply. The reduction of the impact force of the water jet caused by various nozzle geometries and cannula settings could be shown. Especially the effect of the shaping of the water jet could be determined.

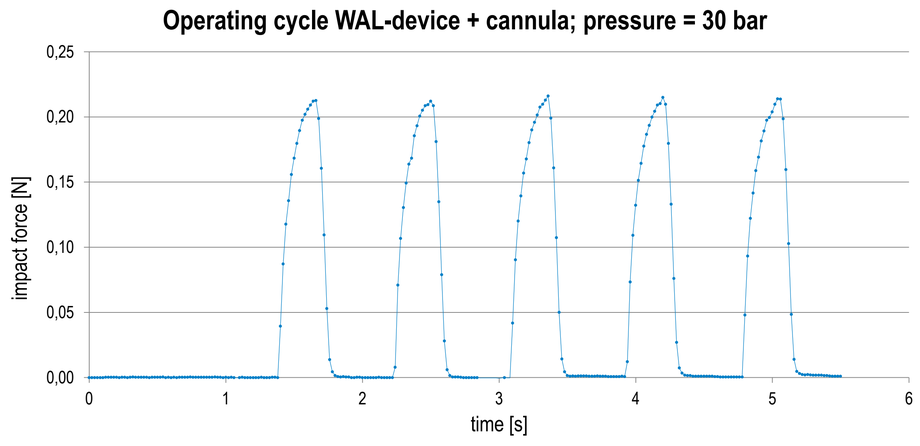

Fig. 7. Characteristic graph of operating cycle of the human med body jet ® evo, five consecutive shots of the water jet can be seen

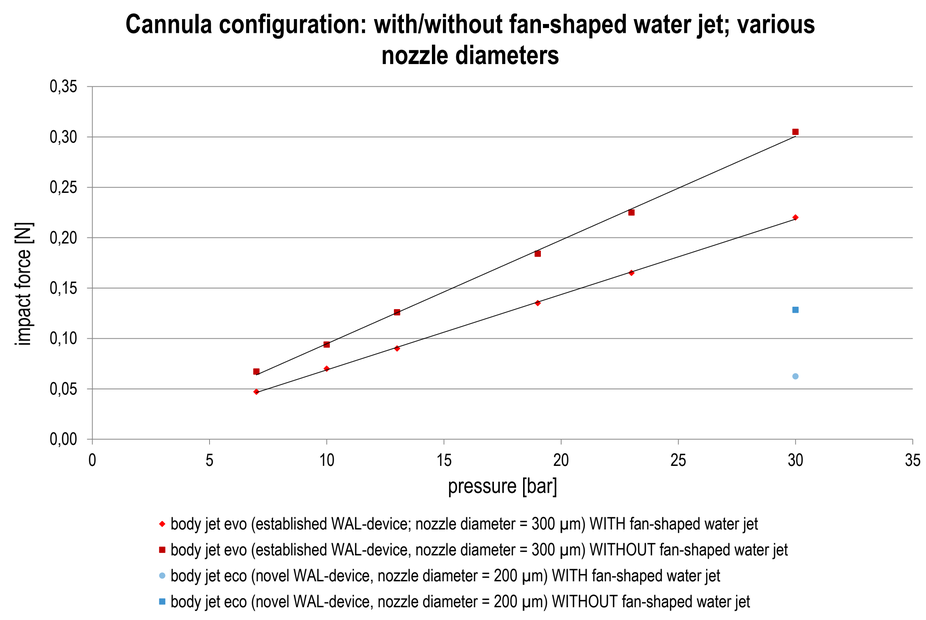

Fig. 8. Reduction of impact force of water jet caused by deflection area of WAL-cannula or nozzle diameter

Conclusion

Further work will include experimental investigations of the water jet of the novel WAL-device in order to optimize the nozzle for a gentle extraction of the ADSC. Measurements of the partial cross-section of the water jet will be performed to identify the distribution of the impact force over the shape of the jet. An evaluation of the results referring the stress on stem cells of human fatty tissue caused by the water jet is in progress.

human med
water-jet assisted medical technologies

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