

The primary objective of the research project was the optimization of geometry of the infrainguinal prosthetic bypass in the site of the distal end-to-side anastomosis. Due to the negative influence of hemodynamics, it is most frequently this location, which is responsible for the longterm failure of the graft.

Our prospective angiographic study in patients as well as experimental and computational simulations indicate that flow type in the anastomosis and wall shear stress (WSS) in particular are the key factors that determine the location of neointimal hyperplasia and promote its progression. Maximum of such changes was located in the toe, heel, and bottom of the anastomosis, and these clinical findings correspond with the results from the simulations.

We carried out several clinical experiments that suggest the importance of the angle of the distal anastomosis of an infrainguinal prosthetic bypass as a key factor in the development (both location and quantity) of neointimal hyperplasia 6 to 24 months following the procedure. The construction of the anastomosis at a more acute angle results in WSS values that are closer to physiological flow. This reduces both mechanical impairment of the endothelial cells and stimulation of the smooth muscle cells. From the researched set of anastomotic angles (25°, 45°, 60°) the most favourable flow with regard to hemodynamics and WSS was obtained when the connection of the distal anastomosis was constructed at 25° angle.