Currently, there is no reliable in-stent restenosis (ISR) chronic total occlusion (CTO) model to assess devices and treatments.

The purpose of this study was to establish a preclinical model of a CTO ISR (Tosaka Class III) lesion within an animal model to assess histologic outcomes following laser atherectomy (CVX-300 Excimer Laser System – Spectranetics, Colorado Springs, CO) with adjunctive paclitaxel-coated balloon (PCB) angioplasty compared to balloon angioplasty (BA) + PCB treatment.

New Zealand White rabbits were fed a 1% hypercholesterolemic diet for 28 days before being switched to a standard diet. On day 7, animals underwent Fogarty balloon injury and carotid artery stenting. On day 62, bovine thrombin was injected within the stent to create the CTO. On day 92, animals were treated with either laser+PCB or BA+PCB. On Day 120, animals were humanely euthanized and treated vessels were harvested for histological analysis.

Eight of 17 animals survived to term. Light microscopy at 28-day treatment follow-up showed that laser+PCB produced smoother lumens with less debris. Delayed healing with reduced endothelialization, adherent inflammatory cells and intimal surface fibrin, was noted within both treatment groups. Angiography was consistent with the histopathologic findings. Although these observations are consistent with paclitaxel drug effects, the effects were more prominent following laser+PCB. Differences between the treatment groups were further supported by reduced stenosis and intimal thickness in the laser group.

This study confirms the feasibility of creating a viable human-like ISR CTO model with successful outcomes after laser+PCB treatment, which may serve as an appropriate strategy in treating challenging femoropopliteal occlusive disease.