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**Mechanical effect of friction and stretching on endothelium denudation**  
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## **Background**

Denudation of artery endothelium during angioplasty is a predictor of restenosis (Kuntz et al, 1992), the main complication of angioplasty. This study aims at quantifying the relationship between endothelial denudation and mechanical causes of denudation, such as friction between the balloon and the artery and stretching of the arterial walls.

## **Methods**

Fresh porcine aortas were cut into 74 axially and 74 circumferentially oriented samples (60mmx15mm). Each sample was mounted onto a friction-testing apparatus, with the luminal side facing a sheet of polyethylene-teraphtalate, and pulled over a distance of 10, 30 and 50 mm, while subjected to a normal force of 0.5kg, 2 kg and 3 kg, with and without a 50% stretch factor in the direction of friction. After friction damage was applied, the luminal side of each segment was treated with 1 mg/ml collagenase, prepared in culture medium (DMEM), for 40 minutes and the remaining endothelial cells were removed by gently scraping the intimal surface. After centrifugation and suspension in culture medium (Keravis et al., 2000), the isolated endothelial cells were counted by hematocytometer. Endothelial cells were also counted on a control group of 19 aorta samples that were not subjected to friction damage.

## **Results**

In axial samples, the stretch factor had no effect on endothelium denudation. A significant loss of endothelial cells was observed in samples subjected to 2kg and 3 kg over 50 mm, and with 3kg over 30 mm. In circumferential samples: compared to non stretched samples, preliminary data shows an increase loss of endothelial cells with a 50% stretch factor on all samples pulled over a distance of 50 mm.

## **Conclusions**

These results suggest that endothelium denudation increases both with friction force and friction distance. Moreover, stretching in the circumferential direction increases endothelial denudation further. These results will help optimize balloon deployment conditions to reduce the occurrence of restenosis.

## **References**

- Kunz RE, et al. *Circulation* 1992; 86(6):1827-35.  
Keravis T, et al. *J Vasc Res* 2000; 37(4):235-49