Dr de Kerchove: We included the subcommissural annuloplasty in the study because this is the technique that has been the most used in clinical practice for ventriculo-aortic junction reduction and stabilization. Of course, it has an effect on valve coaptation. It increased the coaptation by plications, or if you prefer, by closing the subcommissural triangle. This portion of the aortic root is just above what we considered to be the ventriculo-aortic junction, so I think it must be considered as a VAJ annuloplasty.

Regarding your second question, we have seen that after non-circumferential annuloplasty, as with subcommissural annuloplasty, you may have recurrent dilatation because the portions between the plication are not supported. We have also observed that the pledget used in subcommissural annuloplasty stitches can migrate inside the aortic wall. Those are the mechanisms explaining the loss of efficacy over time of the subcommissural annuloplasty. With a prosthetic ring annuloplasty, as in the reimplantation technique, for example, you stabilize the annulus circumferentially with a prosthesis, as you also do in mitral or tricuspid annuloplasty. You really have another reinforcement of the annulus than happens with subcommissural annuloplasty. Long-term follow-up data on mitral and tricuspid valve repair or on the Tirone David operation suggest that the annuloplasty rings are probably more stable than the de Vega annuloplasty or the subcommissural annuloplasty.

In the past 15 years, aortic valve repair has evolved from an occasional procedure to a reproducible treatment option for many patients with aortic valve regurgitation. With increasing experience, the principles of cusp and root repair have become more refined. In addition, specific problems have crystallized that require special solutions in order to make reconstruction of the aortic valve a reproducible and standardized operation. De Kerchove et al. [1] present an experimental study on one such detail, i.e. aortic annuloplasty.

The diameter of the aortoventricular junction has previously been assumed to be important in valve-preserving root replacement. Recent evidence has pointed out that aortoventricular dilatation is indeed a predictor for long-term aortic valve failure, not only in valve-preserving aortic replacement [2, 3] but also in isolated aortic valve repair [4]. In analogy to the principles of mitral repair it thus seems plausible to introduce a standardized annuloplasty concept into aortic valve repair. Stabilization of this anatomic structure by applying aortic valve reimplantation within a vascular graft has not uniformly resulted in adequate valve stability [3]. This aggressive form of root replacement also appears unjustified in the absence of root dilatation.

Different concepts of an annuloplasty approach have been proposed, i.e. external ring, internal ring or suture annuloplasty. At this time, there is no evidence of the superiority of one technique or implant over another. The use of a circular suture annuloplasty was reported by Taylor in 1958 [5]. The proposal of a subcommissural plication stitch was published by Cabrol et al. [6]. In a recent clinical report the use of these sutures was associated with increased risk of reoperation [4].

Few annuloplasty devices have been used clinically in the past 10 years. The biggest clinical experience has been obtained by Lansac et al. [2] with an expansible external device. The authors were able to document freedom from adverse events due to the device for up to two years and reproducible results of aortic valve repair despite a high number of centres involved. Hahn [7] reported on a partial external annuloplasty, but the effect of the technique was not well documented and it was mostly used in conjunction with pericardial cusp replacement. Fattouch [8] presented data on a combined internal and external annuloplasty, from the mixed clinical experience the effect of the devise is difficult to extract. Similarly, Izumoto [9] described the use of an internal annuloplasty without specifying results and providing a control group. At this time, experimental evidence is available only for other annuloplasty devices.

Thus, there is growing interest in an annuloplasty for the aortic valve and the increasing impression that it will be beneficial for aortic valve repair. At the same time, there is uncertainty as to the best mode of application of such a device (external vs. internal) and the best type of material (expansible, flexible or rigid). For clinical decisions, haemodynamic function, stability and biocompatibility will be essential. The device will have to effectively stabilize the aortoventricular junction at the desired diameter. It should not have acute or long-term interference with the conduction system and cusp mobility and structure.
Our own experience has shown that prosthetic material close to cusp tissue may lead to inflammatory changes and cusp restriction. At this point an external placement plausibly appears to be the most promising option.

In the current in vitro study de Kerchove et al. [1] have investigated the haemodynamic effects of different applications of annuloplasty rings and compared them with the old technique of subcommissural plication. The ring annuloplasty provided a greater reduction of aortoventricular diameters and increased transvalvular gradients. They found some differences with respect to the type of annuloplasty placement, in that external placement resulted in ‘paravalvular’ remodelling.

The findings are not surprising. A weakness of the subcommissural plication suture [6] is its lack of standardized size reduction, similar to suture annuloplasty of the mitral annulus. The slight differences between external and internal application of the prosthetic ring, however, are difficult to interpret, in part because of the model chosen.

In the normal human aortic valve, the aortoventricular junction may actually be more cranial than the nadir of the sinuses of Valsalva, in particular, in the right coronary sinus [10]. Clinically, this is often referred to as a ‘paper-thin sinus wall’. It appears logical that an annuloplasty device should be placed at or slightly below the nadirs of the sinuses, thus at the level of the basal ring. The pig heart differs from human anatomy in that it regularly has a wide discrepancy between the basal ring and the aortoventricular junction in the right coronary sinus. In addition, there is a wide septal muscle shelf just below the insertion of the right cusp. Any external placement of a graft or annuloplasty will be anchored halfway into the sinus and may directly lead to distortion of aortic valve geometry. Thus, it is difficult to determine whether the findings of the current study are due to the placement of the device or rather the consequence of the porcine cardiac anatomy. Further investigations should probably be done on specimens that are closer to normal human anatomy, e.g. cadaver valves or homografts.

As the need for an aortic annuloplasty device is becoming clearer, more information will be necessary before the ideal device is routinely applied. The authors are to be congratulated for their attempt at producing more evidence in a systematic fashion. Further research is needed and should take the anatomical details of the human aortic root into consideration. In addition, the effect on cusp motion and long-term cusp integrity will have to be carefully studied.

Conflict of interest: none declared.

REFERENCES