consensus to date. The factors involved in the postoperative regression of IMR are too complex and numerous to be attached to a given procedure. Thus, the association of all these techniques may represent the best approach to treat this pathology. We should not forget that some colleagues would still be partisan of the “nothing” technique, preferring to implant the mitral prosthesis with chordal conservation instead of multiplying the techniques.

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Reply to the Editor:

We appreciate the comments by Dr Fayad and colleagues. We agree on some details, but we definitely disagree on some important aspects.

Dr Fayad indicates that our patient population was unfavorable to document the benefit of the RING + STRING approach for patients with ischemic mitral regurgitation (IMR), because in this category of patients, the likelihood of residual/recurrent mitral regurgitation after mitral valve repair is extremely high. We agree on the risk of recurrence, but we feel that this high-risk subgroup of patients is ideal as a

tough test of any therapeutic intervention. All patients included in our case series exhibit a combination of annular dilatation (Carpentier type I leaflet motion) and severe leaflet tethering (Carpentier type IIb leaflet motion) due to papillary muscle displacement. According to Calafiore et al,¹ mitral valve replacement is the treatment of choice for this patient subgroup with tenting height exceeding 10 mm. The RING + STRING approach however has been shown to allow mitral valve repair in this high-risk subgroup.

Dr. Fayad also points out that the nature of IMR is highly important. This is certainly true. We would like to emphasize that all of the patients in our case series suffered from ischemic cardiomyopathy (EF < 30%) with severe chronic IMR, as mentioned above. The experimental concept of the STRING technique had been previously evaluated in a sheep model of acute mitral regurgitation.² However, this model of acute IMR also showed the pathogenetic features of IMR (ie, annular dilatation, leaflet tethering due to papillary muscle displacement) and allowed to build the experimental basis for this new concept of subvalvular repair.

Referring to Dr. Fayad's question about the nature of the underlying tenting phenomenon, we do think that “anterior or posterior tenting” are misleading terms for surgeons who are not experts in transesophageal echocardiography. All of our patients had a tenting height (ie, end-systolic orthogonal distance between the annular plane and the coaptation point of both leaflets) exceeding 10 mm visualized in the midesophageal left ventricular (LV) long axis view (approximately 150 degrees), due to displacement of the posterior papillary muscle (distance posterior papillary muscle tip; fibrosa exceeding 40 mm). In a few patients with excessive global LV dilatation, we have also observed displacement of the anterior papillary muscle. Based on our encouraging results with the STRING technique, we have started to place a second STRING suture to reposition both anterior and posterior papillary muscles; however, these patients are not included in the current investigation.

We completely agree with Dr. Fayad that echocardiographic evaluation in the follow-up under exercise conditions might demask latent mitral regurgitation as well as transmitral gradients and con-

tribute to our results. However, according to the current literature, undersized ring annuloplasty represents the treatment of choice for functional mitral regurgitation, and transmitral gradients (at rest) were negligible in the published series.^{3,4}

Chordal cutting has been a suggested method to relieve leaflet tethering by Messas et al.,⁵ but its effect on systolic LV function has been considered controversial.⁶ Detrimental effects associated with chordal cutting have been documented by measuring load-insensitive parameters of LV function (ie, end-systolic elastance, preload-recruitable stroke work) in a sheep model.⁷ We thus speculate that these negative effects may be even more pronounced in severely impaired ventricles. The STRING technique eliminates residual leaflet tethering after undersized ring annuloplasty and normalizes leaflet morphology under echocardiographic guidance in the loaded beating heart. The second-order chordae remain intact, and the STRING might thus function as a third-order chord to prevent further detrimental LV remodeling. Because our technique of papillary muscle repositioning corrects subvalvular pathologic conditions and has been effective even in high-risk patients (see supplemental material of our article available online: Intraoperative transesophageal evaluation of the RING + STRING technique in a patient with an EF of 10% and severe leaflet tethering with a tenting height of 19 mm), we do not think that supplementary chordal cutting should be added.

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