# PCI for Ostial Lesion

## ii) LAD ostial

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PCI for a LAD ostial lesion is well-known to be associated with a high restenosis rate because of excessive elastic recoil after dilation. Therefore the best strategy for this lesion is to prevent the recoil after dilation. Other issues in PCI for a LAD ostial lesion are diffuse plaque linked to LMT bifurcation or LCX ostial lesion and plaque shift to LCX caused by dilation of LAD ostial lesion. The damage of the diffuse plaque existing in LMT bifurcation or LCX ostial caused by dilation of LAD ostial lesion could contribute to progression of LMT or LCX lesion several months after PCI. Also plaque shift brings about a new lesion. Since stent era, stent implantation in LAD ostial was expected to overcome the recoil and to result in the elimination of restenosis. However, it has been reported that stent implatention in ostial LAD is not associated with acceptable long-term results despite relatively lower restenosis rate compared to balloon angioplasty. The issues of LAD ostial stenting involve stent jail of LCX, induced LMT or LCX ostial disease and refractory stent restenosis. These problems in LAD ostial stenting are mainly caused by massive plaque existing in LAD ostial and/or LMT. From recent experience stent implantation following plaque removal in LAD ostial is expected to bring out more favorable results compared to stent alone strategy. The plaque removal can prevent plaque shift and also help stent struts to expand fully in LAD ostial.

Sixty-seven consecutive patients with a LAD ostial lesion undergoing PCI in our institution since 1998 were analysed. In 48% of these patients, LAD ostial lesions were accompanied with diffuse lesions in distal LMT and/or LCx ostium. Stent was used in 51% of the patients and directional coronary atherectomy(DCA) in 54%. DCA prior to stenting was adopted in 15%. Although one patient had subacute thrombosis and another patient died of VF 2 days after procedure in stent group, target lesions were successfully dilated in all patients. At 6 months follow-up, restenosis rate in DCA prior to stenting group was lowest(11%) among other groups(DCA alone group 31%, stenting alone group 53%). In addition to the restenosis rate, new lesion or progression in LMT and/or LCx ostial was more frequently found in stenting alone group compared to DCA group(26% vs 8%). This study indicates that plaque removal prior to stenting in LAD ostial lesion is mandatory not only to reduce restenosis rate but also to avoid progression or new lesion, especially in the patients who have diffuse plaque in LMT or LCx ostial linked to LAD ostial lesion.

### a) stenting strategy

There are some dilemma in stenting strategy for LAD ostial lesions. Namely high pressure inflation is needed to fully expand stent struts at the orifice of LAD and relatively large balloon is also required according to the vessel size. Because the vessel diameter at the orifice is more than 4.0mm in most of cases, at least 3.5mm stent is usually used to reduce the restenosis rate. However, this strategy often results in plague shift or a press of the vessel wall in LAD to the orifice of LCx and consequent lesion at the orifice of LCx. Some physicians are afraid of the adverse effect of the strategy and tend to adopt a conservative strategy for LAD ostial lesions. The inadequate stent expansion is known to often cause restenosis especially in the orifice lesion. Also the restenosis after stent implantation at the orifice is refractory in case of inadequately stented lesion.

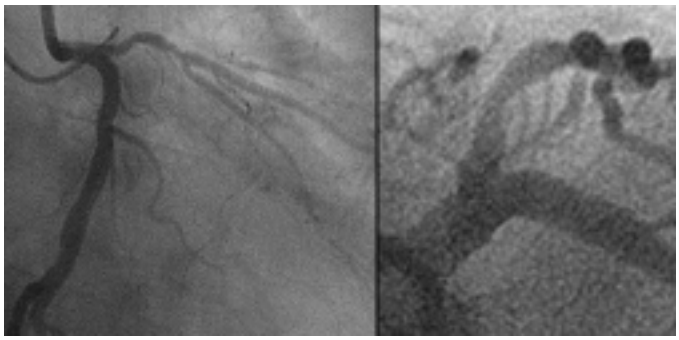
There are two issues to be considered when deploying a stent in LAD ostila lesion. One is to avoid the stent recoil and another is to deal with the plaque shift. As described above these issues are interactive if plaque is not removed around the orifice.

Stent recoil: when a stent is deployed as the proximal edge of stent is positioned just at the orifice of LAD, stent recoil easily occurs at the proximal edge in case of a hard lesion. In addition to that, it is too difficult and sometimes impossible to truely position the stent edge just at the orifice because LAD usually branches from LMT at an angle. The stent edge is partially protruded to LCx or does not completely cover the orifice. Therefore a stent is usually deployed as blocking LCx so that the stent body can support the orifice. Even if the stent body supports the orifice, stent recoil frequently occurs at the orifice due to uncompressed hard plaque. To overcome the stent recoil post dilation with high pressure is routinely required if IVUS is not used as a guidance. Another reason of stent recoil is stent deformation caused by dilation of LCx if necessary to deal with plaque shift. To avoid the stent deformation kissing balloon technique should be adopted when LCX orifice is dilated. To get the better result, both balloons used for kissing inflation should be dilated with high pressure untill those are completely expanded. Although a stent with strong radial forse tends to be used, a stent which is able to access the side branch(LCX) should be selected for LAD ostial lesion.

Plaque shift: if there is diffuse plaque in LMT or LCx orifice linked to LAD orifice lesion, full expansion of a stent deployed in LAD orifice frequently causes plaque shift if the diffuse plaque is not removed prior to stenting. Not only plaque shift but also extensive dissection could occur in those lesions.

In that situation, additional stent is sometimes needed. If you need Y stenting or T stenting, post dilation with higher inflation pressure using kissing balloon technique is mandatory to get optimal stent expansion of both stents. However, idealy Y/T stenting should be avoided because these technique cannot prevent restenosis. Moreover, diffuse instent restenosis sometimes occurs after Y/T stenting and it is extremely difficult to deal with the instent restenosis. Stenting cannot solve these problems without debulking.

figure 1: Case1-pre-PCI



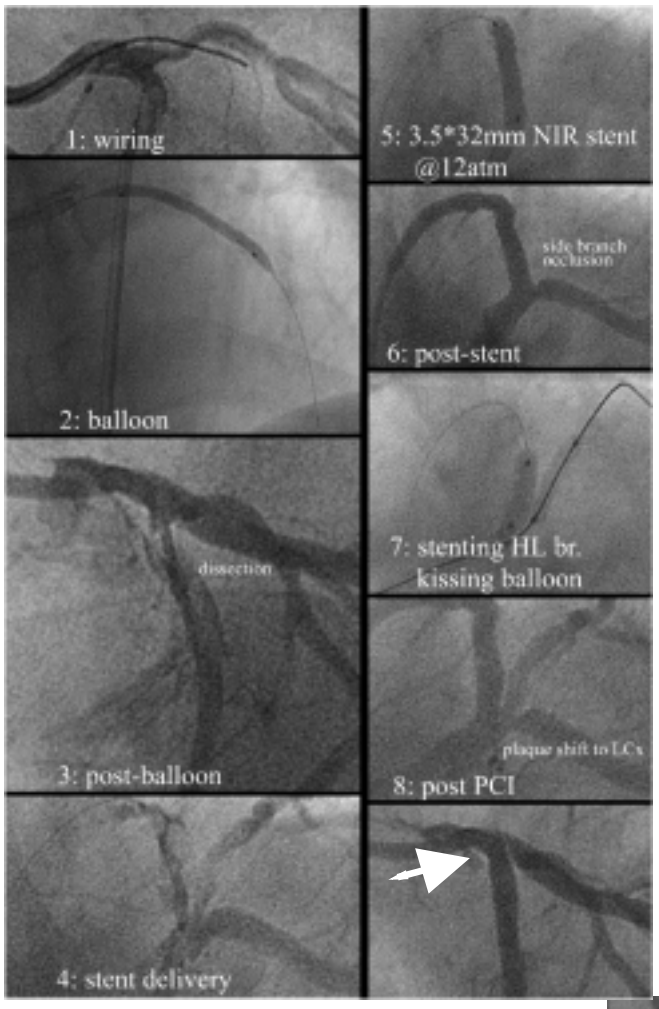



figure 2: Case1-stenting the orifice of LAD

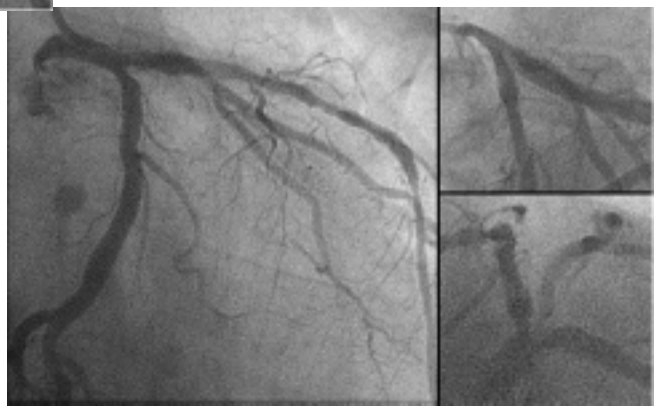
Case 1: Chronic total occlusion(CTO) at LAD ostial( fig 1).

It was relatively difficult to find the entrance of CTO. The guide wire successfully went into CTO at proximal point than expected( fig 2: pic 1). After crossing the CTO, 3.5*32mm NIR stent was deployed as the proximal end of stent was positioned just at the orifice( fig 2: pic 4). After deploying the stent, a large side branch was occluded(fig 2: pic 6). To rescure the side branch, another 3.0*15mm Multilink stent was put in the orifice of side branch using kissing inflation technique( fig 2: pic 7). As a result 2 stent placement caused a new stenosis at the LCx orifice( fig2: pic 8). Despite high pressure post-dilation(16 atm:3.5mm balloon) insufficient stent expansion was seen at the orifice of LAD probably due to stent defomation( fig 2:pic 9).

Three months follow-up angiography revealed the restenosis at the orifice of LAD, LCX and the side branch(fig 3).

In this case the guide wire went though the oppsite site of the side branch, consequently plaque shift occurred after stenting. The second stent disturbed the full expansion of the first stent and also pushed the vessel wall toward LCx.

figure 3: Case1-3months after PCI



Case 2: Stenting for LAD ostial lesion accompanied by LCx ostial lesion.
There was diffuse plaque around distal LMT including the orifice of LAD and LCx( fig 4). After pre-dilation of the orifice of LAD 3.5*15mm Multilink stent was deployed as the proximal segment of the stent cover the distal LMT lesion( fig 5:pic 1,2). High pressure post-dilation(16 atm) was done with 4.0mm balloon protecting LCx with another wire(fig 5:pic 4) and then the orifice of LCX was dilated with 3.0mm balloon through the struts so that baloon did not injure the proximal lesion in LCx(fig 5:pic 5).

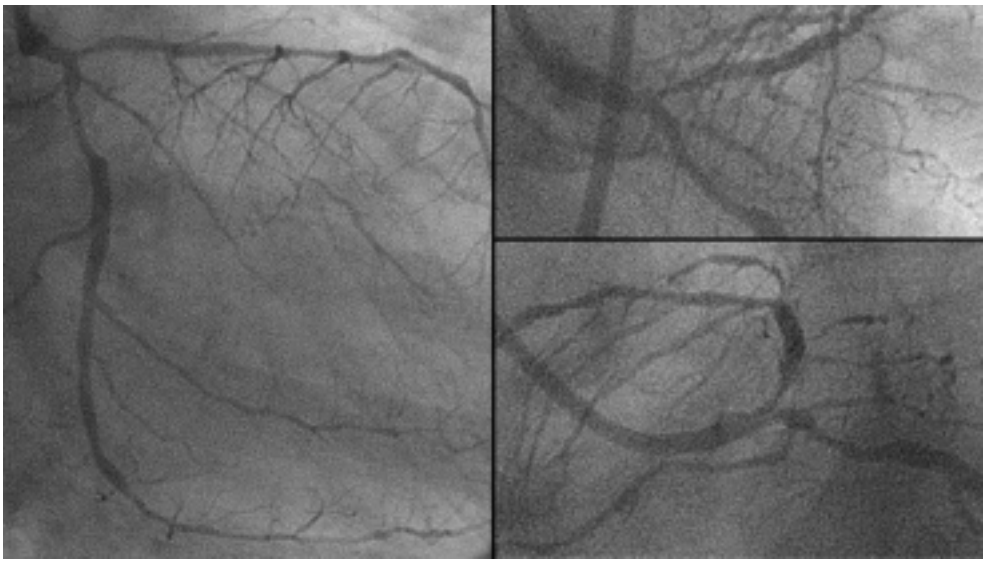


figure 4:case2-pre PCI

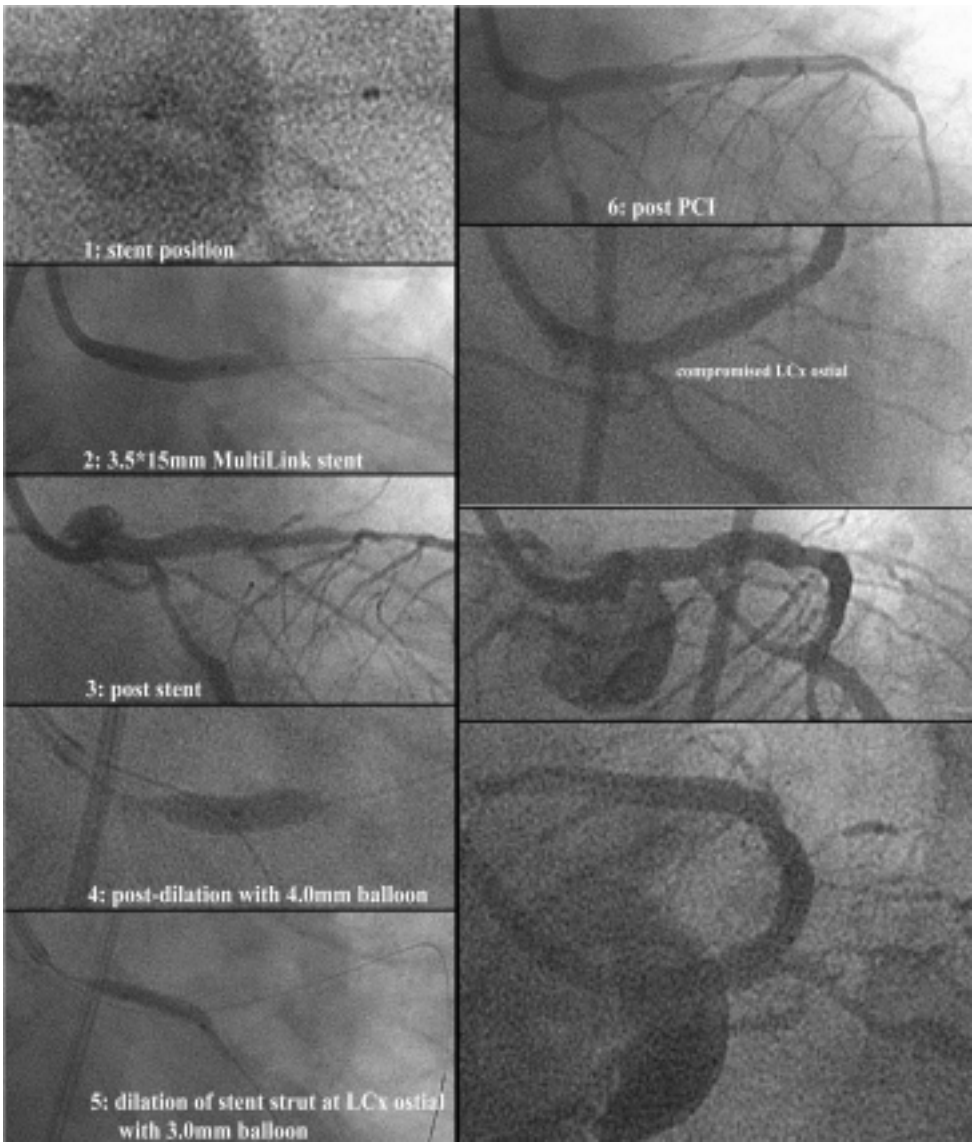



figure 5:case2-stenting LMT and LAD ostial

Suboptimal dilation of the LCx orifice was seen after ballooning due to recoil or plaque shift( fig 5:pic 6).

Usually it is difficult to obtain the optimal results with stenting in LAD ostial lesion with diffuse plaque like this case. In this case the final angiographic appearance seems to be acceptable except the orifice of LCx. In fact post-procedure IVUS showed more than 3.0mm minimal lumen diameter in LAD and LMT. However IVUS also demonstrated massive plaque around stent in LAD orifice. Stenting for this sort of lesion sometimes brings about the poor late outcome.

This patient had cardiogenic shoch 2 months after the procedure. Urgent coronary angiography revealed severe restenosis in the orifice of both LAD and LCx( fig 6).

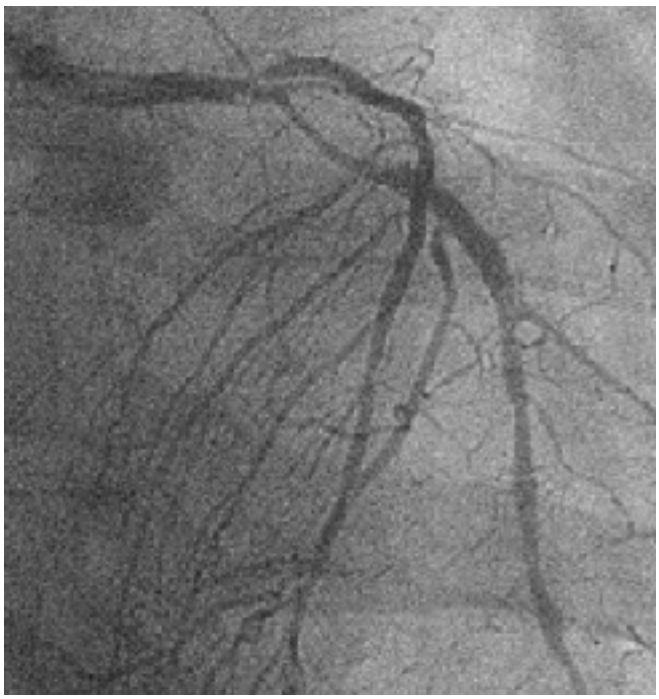


figure 6: case2-urgent angiography 2 months after the PCI and repeat PCI was immediately carried out.

RotaStent: for highly calcified LAD ostial lesion Rotablator is mandatory to get optimal stent expansion. Calcified plaque is often observed across the orifice of LAD. If the eccentric lesion with heavy calcification is seen at the orifice, stent is unable to be fully expanded because it is easily compressed by caicification. Although Rotablator is effective for this kind of lesion, relatively large burr should be used to obtain the optimal results.

Case 3: Rota-Stenting for heavily calcified lesion at the orifice of LAD. In this case Rota-POBA was rather scheduled instead of stenting because of heavy calcification in distal LMT and LCX as well and the gap of the vessel size between LMT and LAD. However 3.5*15mm Multilink stent was placed as straddling LCx orifice because severe dissection in distal LMT and LAD orifice was seen after Rota-POBA(figure8). Key point of stenting in this case is the stent size deployed and the balloon size of post-dilation just for LMT. If restenosis occur after PCI, it might involve distal LMT. Therefore the stent placed in distal LMT and the

figure 7: Case3- pre PCI

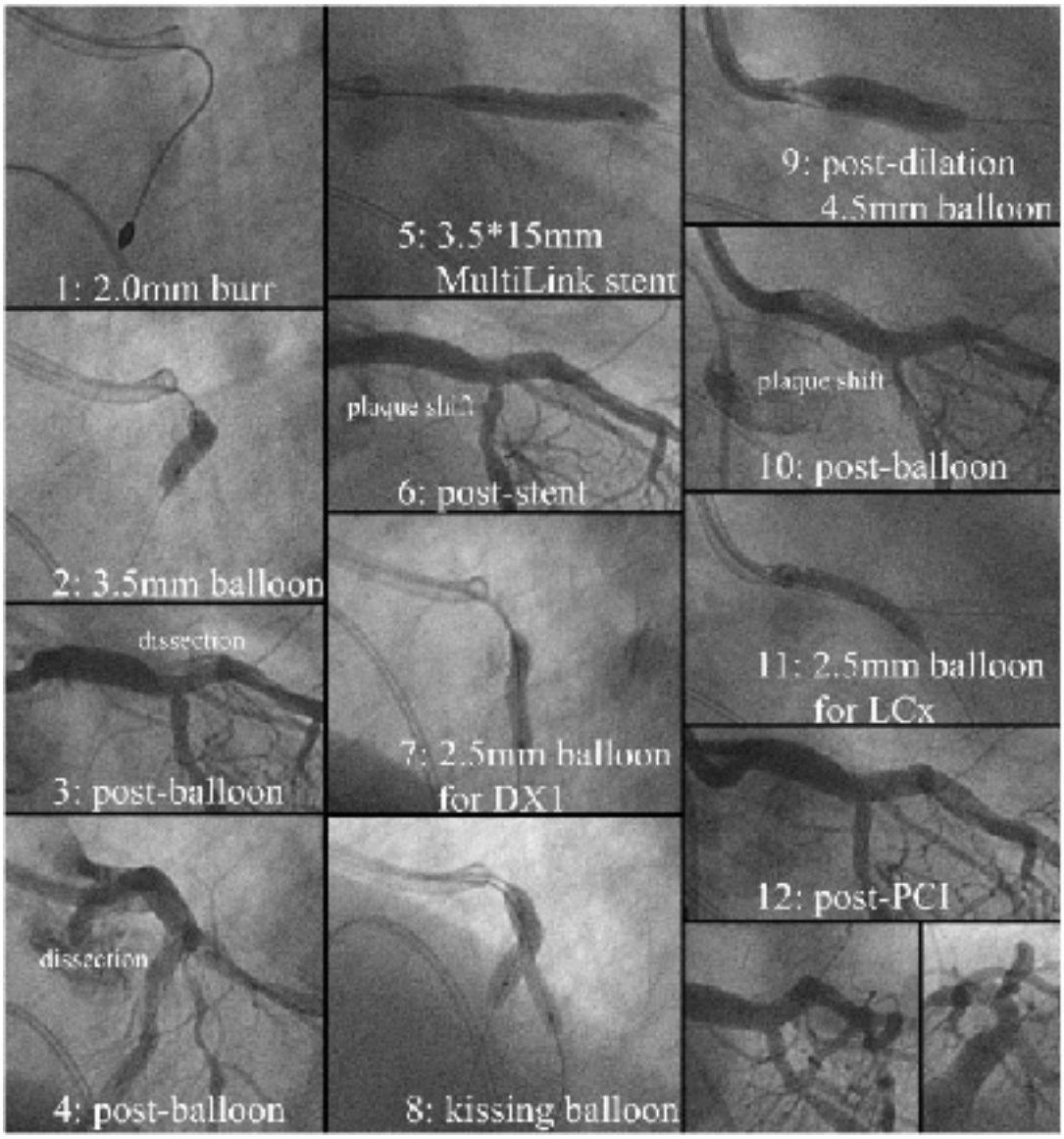



figure 8: Case3-Rotastenting

figure 9: Case3-1 year folllow-up angiography

orifice of LAD should be fully expanded despite heavy calcification. For this purpose the stent struts located in distal LMT was dilated with 4.5mm balloon. The stent was successfully with good apposition to the vessel wall and it was confirmed with IVUS. Rotablation are considered to be very effective in getting the optimal result without high pressure inflation and Multilink stent was also efficacious for side branch access.

One year follow-up angiography showed no restenosis in LMT, LAD and the orifice of LCx(figure9).

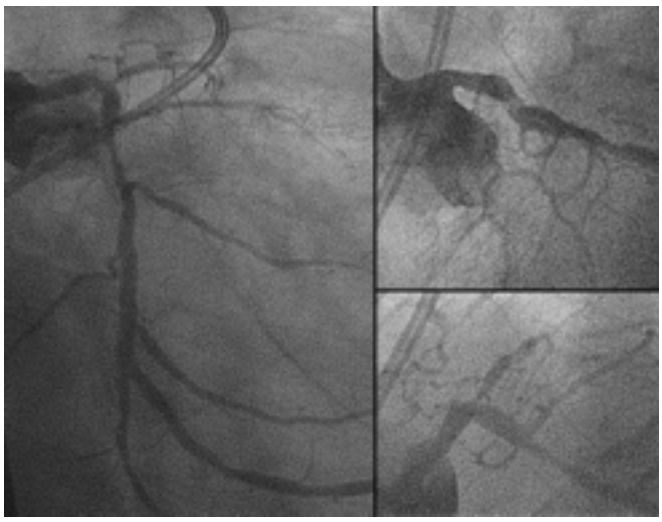


figure 10: Case 4- pre PCI

Case 4: calcified CTO located in LAD ostial. Because not only severe calcification but also 50% stenosis at the orifice of LCx were found, rotablation prior to stenting was planned after successful wiring. In addition to these anatomical condition, the entry of CTO existed opposite the LCx. It means that stenting without debulking causes plaque shift to LCx.

In this case 3.5mm NIR stent was deployed after rotablation with 2.0mm burr as the proximal end of the stent was placed just at the orifice of LAD so that plaque shift to LCx caused by stenting was minimized. However, suboptimal stent dilation was seen due to heavy calcification.

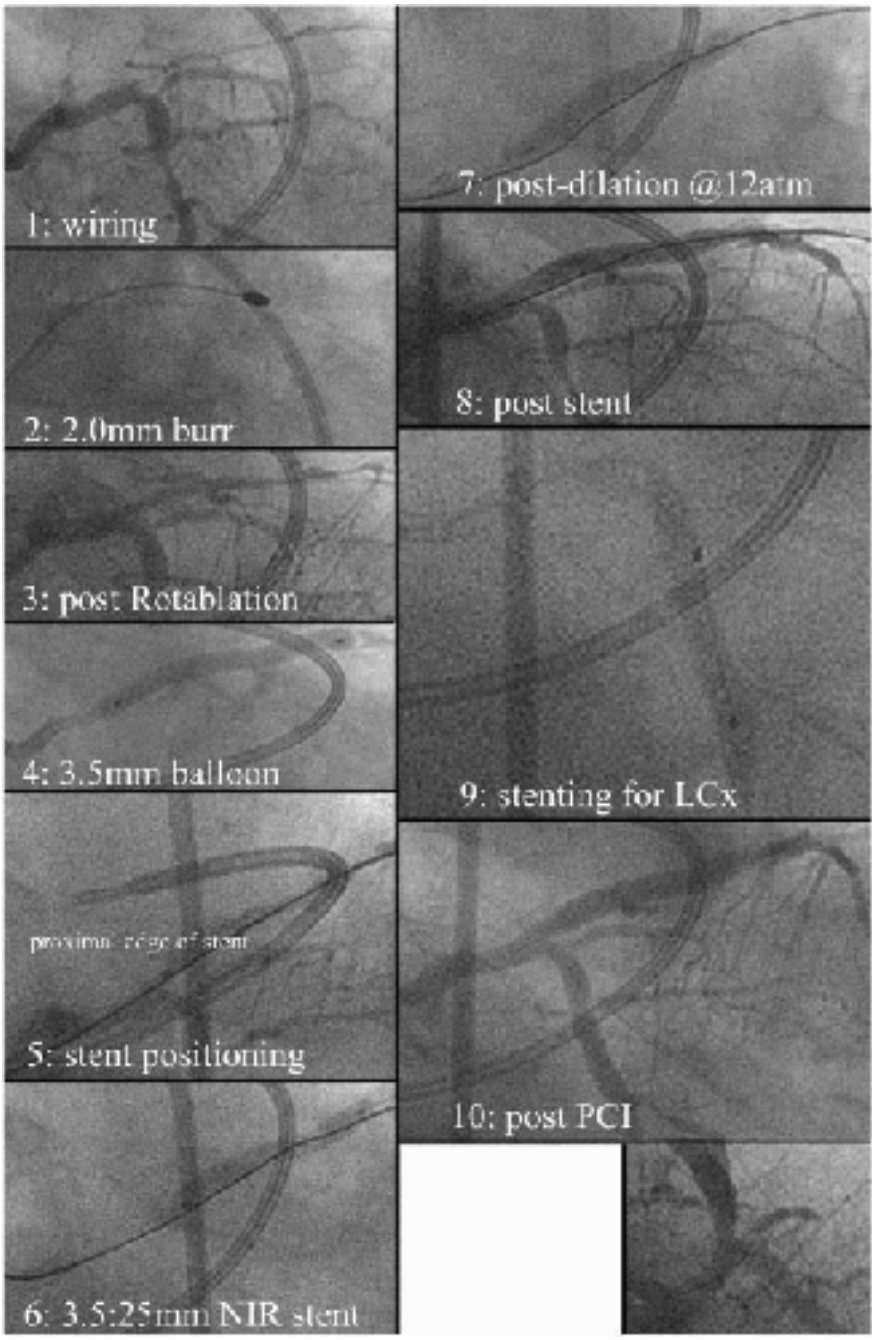



figure 11: Case 4- Rotastenting

figure 12:
Case 4-3months follow-up angiography

Unfortunately this patient had new lesion in LMT and mild restenosis in the suboptimally dilated segment.

## b) Directional Coronary Atherectomy(DCA)

There are the obvious limitations in stenting strategy for treating a LAD ostial lesion. DCA provides the solution to avoid the plaque shift which is one of the major problems when stenting it. However aggressive debulking is needed to prevent restenosis with DCA. Consequently IVUS is mandatory for the optimal and safe removal of the plaque. Although DCA for LAD ostial lesion is relatively easy because of the easy orientation for cutting with IVUS, careful cutting is required if the eccentric plaque is located beside the orifice of LCx. The reason is because deep cut easily occurs in that case. Flexcut$^{R}$ L is usually proper for LAD ostial lesion because of vessel size. Unusual high pressure is sometimes needed to get large working area according to the vessel size. However there is also limitation to reduce restenosis rate with DCA in LAD ostial lesion because of elastic recoil and/or negative remodeling after DCA.

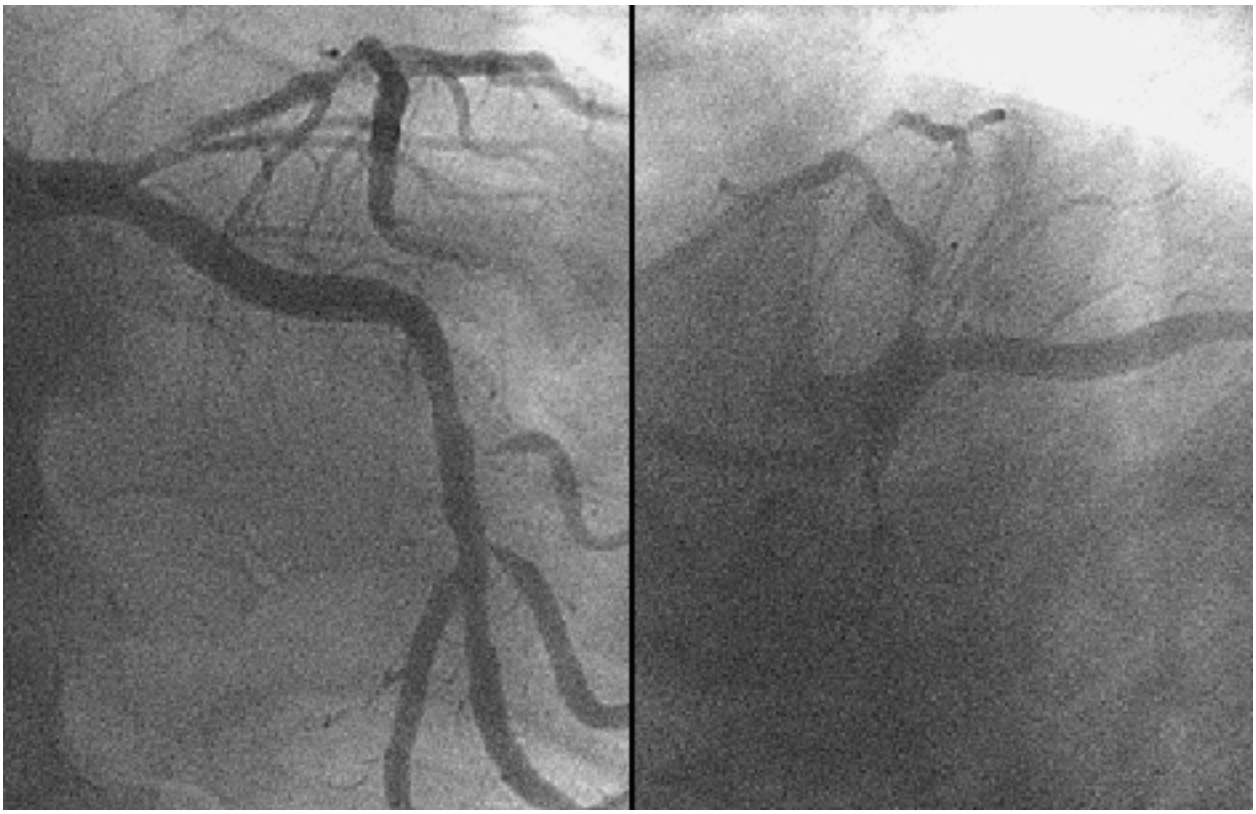


figure 13: Case 5-pre PCI

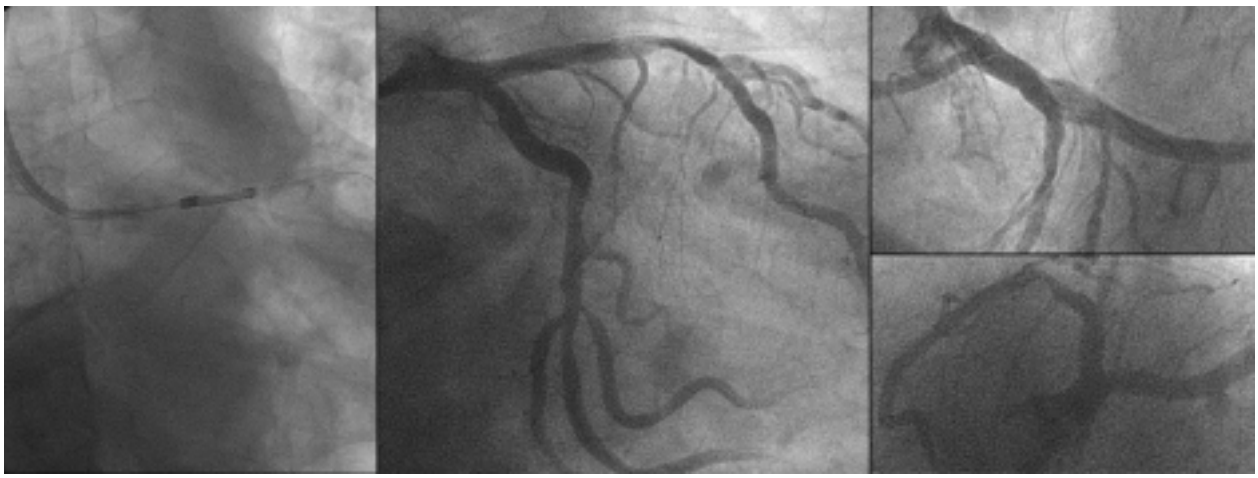


figure 14: Case 5-DCA for LAD ostial lesion

Case 5:in this case the removed tissue was 40.3mg. The optimal debulking was achieved using 7FG with high pressure(50 psi). However restenosis was seen 3 months after DCA(figure15).

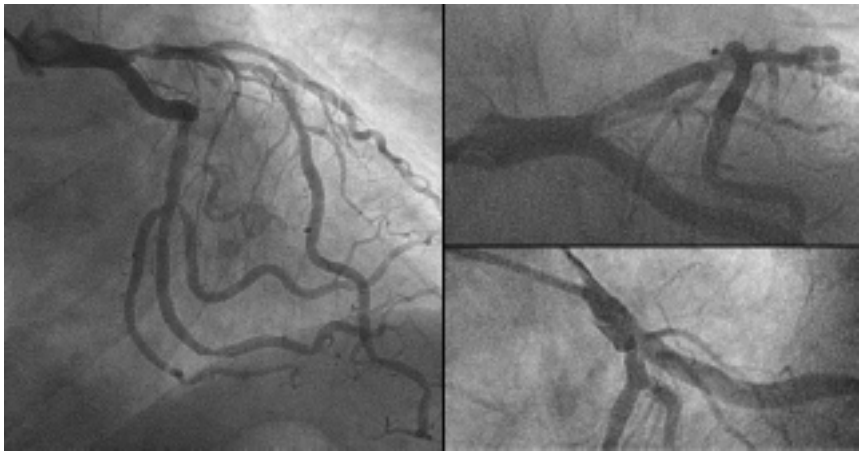


figure 15: Case 5- 3 months follow-up angiography

## c) DCA prior to stenting

As already described, the restenosis rate after DCA prior stenting is the lowest among other strategies. The advantage of this strategy is as follows.

1. bigger acute gain because of easy full expansion of stent
2. minimized plaque shift due to plaque removal
3. no need to precisely position the stent edge just at the orifice of LAD: it allows to prevent plaque shift and to remain various options for subsequent intervention if restenosis occurs.

However more optimal debulking is required compared to debulking stent in other lesions in order to prevent elastic recoil at the orifice of LAD and plaque shift to LCx after stent placement.

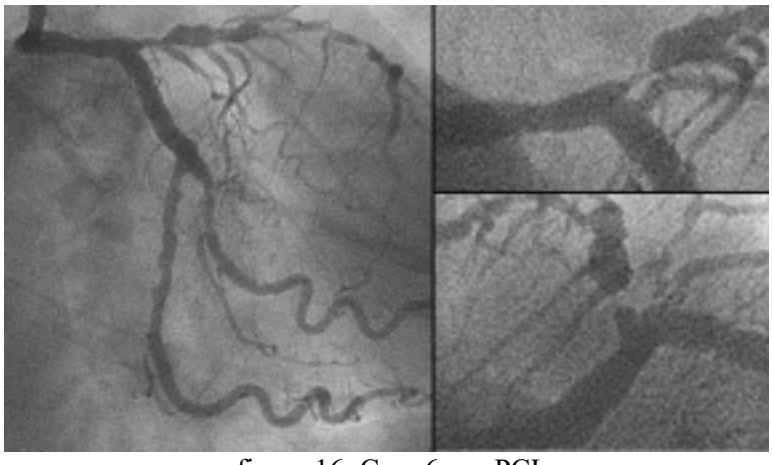


figure 16: Case 6-pre PCI

Case6:DCA prior stenting for isolated LAD ostial lesion.

After aggressive debulking guided by IVUS, large stent was deployed just at the orifice of LAD. The recoil of stent was minimal so that large acute gain was obtained. One year follow-up angiography revealed no restenosis(figure 18).

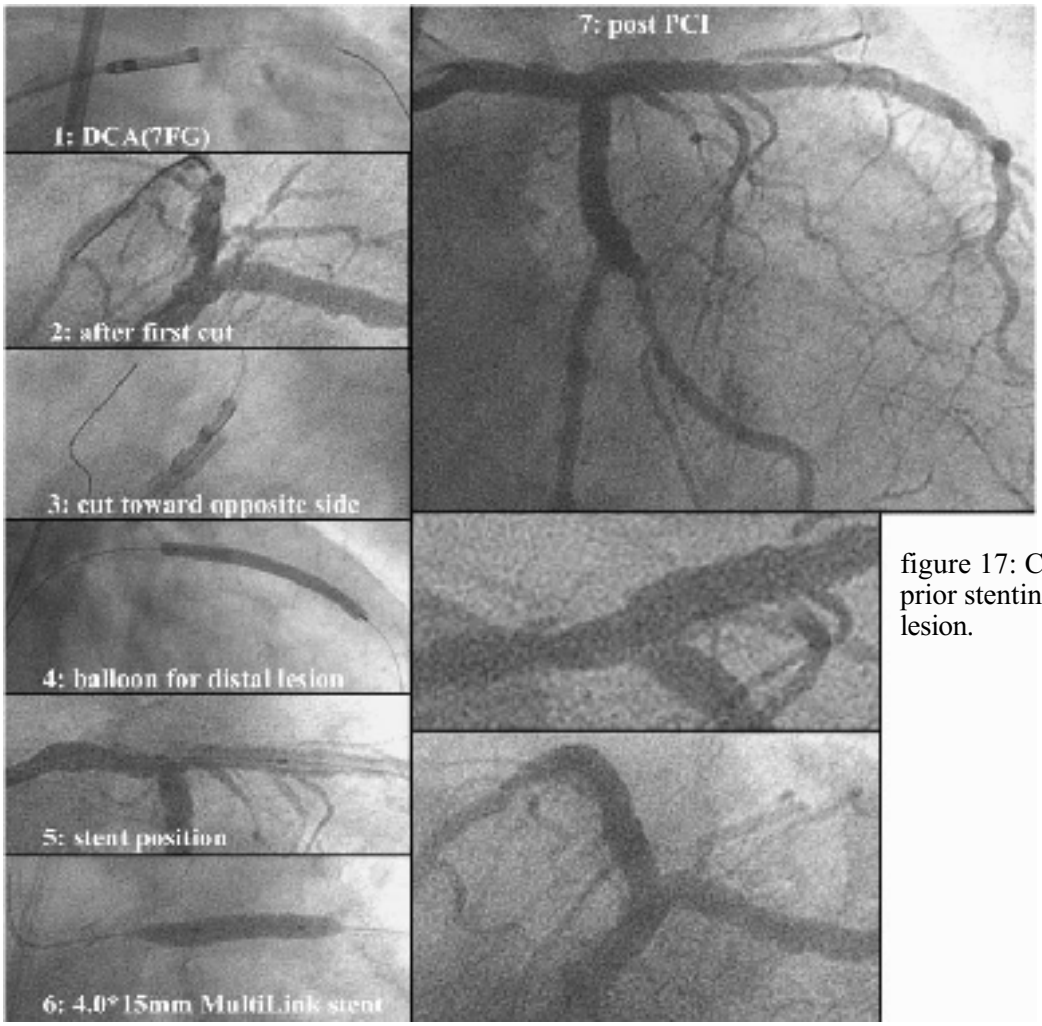



figure 17: Case 6-debulking prior stenting for LAD ostial lesion.

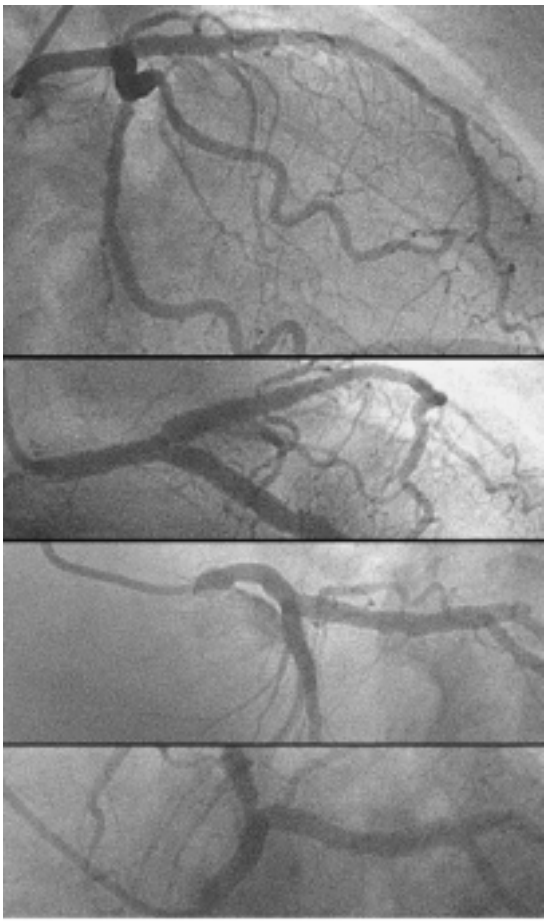


figure 18: Case 6-1 year follow-up angiography

Case 7:debulking stent for LMT equivalent case. The anatomocal condition in this case was expected to easily cause plaque shift after stenting. Therefore DCA prior to stenting was planned. After the optimal debulking(60 psi, removed tissue weight 31.5mg), 3.5mm Multilink stent was deployed and then LCx lesion was dilated by cutting balloon though stent struts.

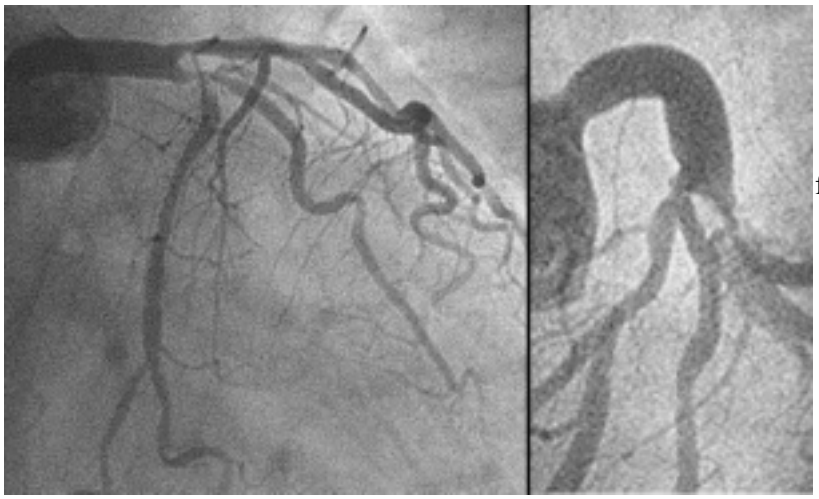


figure 19: Case 7-pre PCI

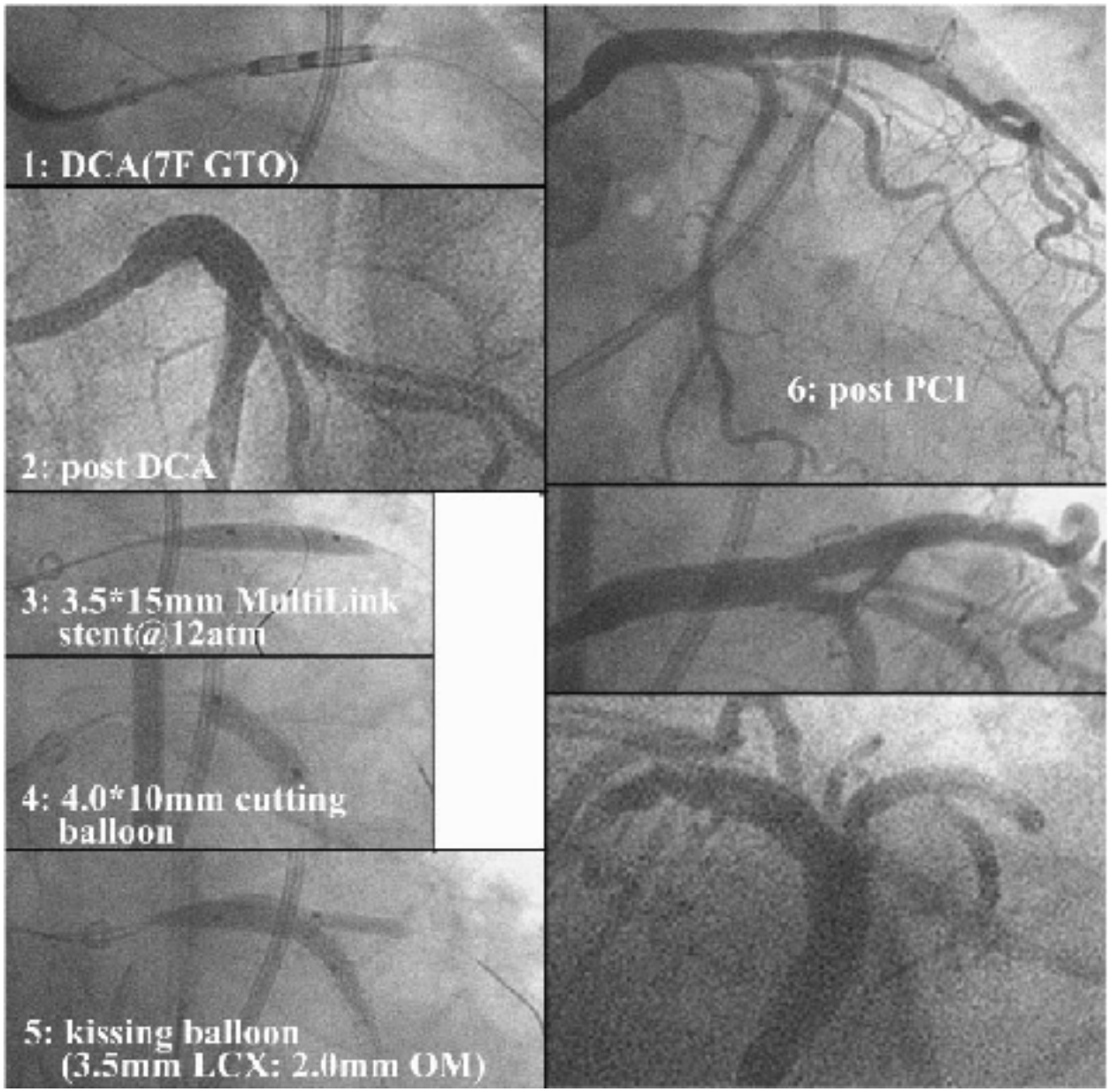



figure 20: Case 7-debulking stent for LMT equivalent lesion

figure 21: Case 7- 6 months follow-up angiography

No restenosis was seen 6 months later.

## Summary

Debulking strategy is more superior than stent alone strategy in case of LAD ostial lesion. Because a new DCA device compatible with 8Fr guiding catheter is available, the debulking strategy will be adopted for the better long term results more frequently than before. It should be emphasized that aggressive debulking is reguired even if followed by stenting in LAD ostial lesion as contrasted with other lesions.