

스텐트 내 재협착 병변에서 엑시머 레이저 성형술 후 조기 및 추적 관찰 소견

정진옥 · 권현철 · 권성욱 · 이성운 · 안경주 · 이상철 · 조옥현 · 박승우
김준수 · 김덕경 · 이상훈 · 홍경표 · 박정의 · 서정돈 · 이원로

Clinical Follow-up of Excimer Laser Coronary Angioplasty for In-stent Restenosis

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ABSTRACT

Background and Objectives : Previous studies have shown a high restenosis rate after balloon angioplasty for diffuse in-stent restenosis. Debulking strategy has been expected to be helpful to reduce the restenosis rate. This study evaluated the safety and long-term clinical event rate after excimer laser coronary angioplasty (ELCA) and adjunctive balloon angioplasty for in-stent restenosis. **Materials and Method :** We included 29 in-stent restenotic lesions treated in 28 patients (18 men, 10 women, mean age 60 ± 2 years) admitted to Samsung Medical Center between June 1997 and August 1998. Quantitative coronary angiography was performed and clinical characteristics, acute complications, 30-day and 8-month major cardiac adverse event rate was analyzed. **Results :** Initial success rate was 97%. We stopped the ELCA procedure in one lesion located in the proximal left anterior descending artery due to bradycardia and hypotension. In the 28 lesions successfully treated with ELCA and adjunctive balloon angioplasty, the minimal luminal diameter increased from 0.7 ± 0.1 mm before ELCA to 1.9 ± 0.1 mm after ELCA and to 2.7 ± 0.1 mm after adjunctive balloon angioplasty ($p < 0.001$). The acute luminal gain after ELCA was 60%. The diameter stenosis decreased from $75 \pm 2\%$ before ELCA to $36 \pm 2\%$ after ELCA and to $15 \pm 2\%$ after adjunctive balloon angioplasty ($p < 0.001$). There was no in-hospital death, Q wave acute myocardial infarction (AMI), emergency coronary artery bypass graft (CABG), but non-Q AMI was noted in 1 case (3%). During the followed-up period of 8 months, there were 1 death (4%) due to congestive heart failure, 1 nonQ-AMI (4%) and 7 target lesion revascularization (26%) among the successfully treated 27 patients, but there was no CABG, Q-AMI. Combined event rate at the 8-month follow-up was 33% and target lesion revascularization rate at 8-month follow-up was 26%. **Conclusion :** The ELCA and adjunctive balloon angioplasty seems to be safe and effective for the treatment of in-stent restenosis. A prospective randomized trial comparing ELCA versus other ablative technique is required. (Korean Circulation J 1999;29(9):891-897)

KEY WORDS : Excimer laser coronary angioplasty · In-stent restenosis.

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: 1999 9 1
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, frequency 25 40 Hz laser pulse
 , 30 - 60 mJ/mm² energy density
 . 25 Hz laser pulse, 45 mJ/mm²
 2 6 4 6
 1
 .
 1-3) ,
 20 30%
 ,
 가
 .
 가
 .
 4)
 ,
 0.7
 ,
 가
 ,
 가
 .
 1.4 mm 1 ,
 1.7 mm 4 , 1.7 mm
 8 , 2.0 mm 16
 (remodeling)
 (intimal hyperplasia)
 5-6)
 (debulking technique)
 .
 0.71 ± 0.1
 가
 30 8 (Major que)
 Adverse Cardiac Event Rate)
 , 가 30%
 ,
 (vapor bubble) (pressure waves)
 .
 가
 1997 6 1998 8
 28 29
 .
 7)
 20 cc
 (catheter flushing)
 1 cc 6 8 cc
 50%
 (diameter stenosis)
 .
 가
 (adjunctive balloon angioplasty) 12
 .
 엑시머 레이저 성형술
 xenon - chloride excimer
 laser system(CVX - 300, Spectranetics Inc)
 . CVX - 300 xenon - chloride
 308 nm 125 200 nsec
 , , ,

30 8 . 가
200 µg
(Quantitative Coro -
nary Angiography) ARRI off - line quantitative co -
ronary angiography system
Mehran
가 10 mm (focal type),
가 10 mm
(diffuse type), 10 mm
(proliferative type),
가 (total occl -
usion) 4가¹⁰⁾
(Major Adverse Cardiac Event, MA -
CE) ,
30 8
통 계
±
SPSS for window
Chi - square test, ANOVA test . p
0.05

결 과

임상 특성 및 스텐트 내 재협착 병변 특성
28 (18 , 10)
60±2 16 ,
9 , 3
19 가
7 , 2
28 Table 1
가 19 가

Table 1. Risk factors of patients

Risk factor	Number of cases (%)
Diabetes	6 (21%)
Hypertension	12 (43%)
Chronic renal failure	1 (4%)
Old myocardial infarction	8 (29%)
Previous CABG	2 (7%)
Ejection fraction<40%	3 (11%)
Current smoker	13 (46%)
Hypercholesterolemia(200 mg/dl)	7 (25%)
LDL(130 mg/dl)	8 (29%)

CABG : coronary artery bypass graft

LDL : low density lipoprotein

Table 2. Angiographic type of in-stent restenosis

Restenosis type	Number of patients
Focal type	8 (27%)
Diffuse type	15 (52%)
Proliferative type	2 (7%)
Total occlusion type	4 (14%)

Focal type : <10 mm, Diffuse type : 10 mm,

Proliferative type : 10 mm/extending beyond stent

가 6 , 4
AHA/ACC B2가 17 , type B 6 , type
C가 4 , type A가 2

(diffuse type)가 가

Table 2

Nir 가 17(59%), Micro
가 5(17%), GR II 가 4(14%), GFX
가 3(10%) , 16 mm가 11 ,
18 mm가 4 , 20 mm가 4 , 24 mm가 1 ,
25 mm가 1 , 32 mm가 6 , 40 mm가 2

14.5±7.3 mm, (re -
ference vessel diameter) 2.7±0.1 mm,
(diameter stenosis) 75±2%

초기 시술 성적 및 합병증

, 29 28
97%

1

5 (17%)
 , Q
 1 (4%) Q
 (reference vessel
 diameter), (minimal luminal diame -
 ter), (diameter stenosis) Fig. 1
 0.7 ± 0.
 1 mm 1.9 ± 0.1 mm
 가 가 2.7 ± 0.1 mm
 가 (p<0.0001).
 (luminal gain) 2.0 ± 0.1 mm
 1.2 ± 0.1 mm 가
 60% 75 ± 2%

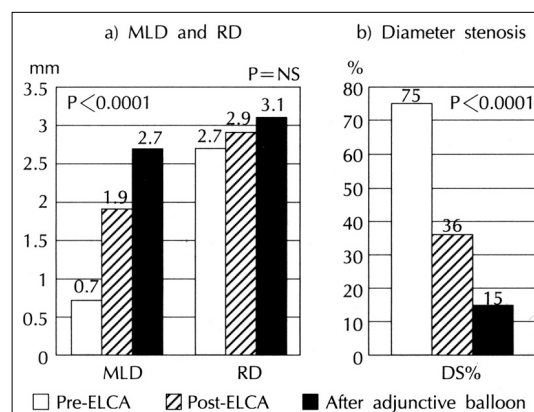


Fig. 1. Acute angiographic results after excimer laser coronary angioplasty and adjunctive balloon angioplasty. (a) Minimal luminal diameter and reference vessel diameter, (b) Diameter stenosis (ELCA : excimer laser coronary angioplasty, RD : reference vessel diameter, MLD : minimal luminal diameter, DS% ; percent diameter stenosis, NS : nonspecific).

Table 3. Clinical follow-up event rate after excimer laser coronary angioplasty and adjunctive balloon angioplasty

	30-Day (n=27)	8-Month (n=27)
Combined event	2 cases (7%)	9 cases (33%)
Death	1 case (4%)	1 case (4%)
Non-Q-wave AMI	1 case (4%)	1 case (4%)
Q-wave AMI	None	None
CABG	None	None
RePTCA	None	7 cases (26%)

AMI : acute myocardial infarction, CABG : coronary artery bypass graft, RePTCA : repeat percutaneous balloon angioplasty

36 ± 2% , 가
 15 ± 2% (p<0.0001).
 30일 및 8개월 추적 관찰 소견
 1 30 8
 27 가 1 (4%) 30
 Q
 , 1 (4%)
 Q 30
 7% 8 27
 30 1 (4%),
 Q 1 (4%)
 , Q , Q
 , 7

Table 4. Analysis of risk factors for 8-month follow-up MACE rate and repeat PTCA

Variables		MACE (%)	RePTCA (%)	P value
Diabetes	yes	17%	17%	P=NS
	no	33%	29%	
Hypertension	yes	42%	33%	P=NS
	no	20%	20%	
LVEF	< 40%	33%	0%	P=NS
	40%	29%	29%	
Smoking	yes	15%	15%	P=NS
	no	43%	36%	
Cholesterol	200 mg/dl	33%	33%	P=NS
	< 200 mg/dl	29%	24%	
LDL	130 mg/dl	29%	29%	P=NS
	< 130 mg/dl	28%	22%	

MACE : major adverse cardiac event, RePTCA : repeat percutaneous balloon angioplasty, LVEF : left ventricle ejection fraction, LDL : low density lipoprotein, NS : non-specific

Table 5. Analysis of lesion type for 8-month follow-up MACE rate and repeat PTCA

Lesion type	MACE (%)	RePTCA (%)	P value
Focal	14%	14%	P=NS
Diffuse	40%	33%	
Proliferative	50%	50%	P=NS
Total occlusion	0%	0%	
Focal	14%	14%	P=NS
Others	35%	30%	

MACE : major adverse cardiac event, RePTCA : repeat percutaneous balloon angioplasty, NS : non-specific

(26%) . , 8 .

33%, Mehran

(Target Lesion Revascularization, TLR) 26% ,

(Table 3).

56% 가

Table 4, 5 . ,

(diffuse type) (proliferative 44% .⁹⁾

type) 18%

가 .

가 ,¹⁰⁾

가 10 mm

19% , 10 mm

35% , 10 mm

50%

83%

27 6 8 가 1

12 (44%) 가 . 12 7

, 4

1 78

15 2

가 , 13

가 .

고 안

가

(rotational coronary artery),

(directional coronary artery,

20 DCA)

30% .

(plaque burden)

가 .⁸⁾

11-13)

Mehran

. R. Hoffman

, , 6

21% 38%

.⁶⁾ .¹¹⁾ Koster

80% 44% ,

895

가 13% 가 , 6
 , Q , Q
 5.7% 12)
 75% 가
 36% 가
 15% , 8 26% ,
 Q 4%

가
 가
 (continuous wave laser sys - tem) 가

(ablative technique) 가

(pulsed wave laser system)가
 (diffuse long le - sion), (saphenous vein graft), ao - rtoostean lesion,
 AMsterdam ROTterdam (AMRO trial) ERBAC
 (Excimer Laser angioplasty, Rotational Athre - ctomy and Balloon Angioplasty for Complex Lesi - ons : ERBAC study)

요 약

연구배경 :

가
 14 - 15)
 (chronic total occlusion)
 (long lesion)
 (saline flush technique)

가
 방 법 :
 1997 6 1998 8
 28 (18 , 10 , 60
 ± 9) 29
 , 30 8

over - the - wire
 가
 (burr)

결 과 :
 97%(28/29)
 16 , 9 ,
 3 . 1
 5 (17%)
 0.7 ± 0.1 mm
 1.9 ± 0.1 mm 가 가
 2.7 ± 0.1 mm 가 ($p < 0.0$
 001). 2.0 ± 0.1 mm
 1.2 ± 0.1 mm

60% .

75 ± 2% 36 ± 2%

가 15 ± 2%

(p<0.00 01). 1 30 8

27 가 . 30

1 (4%) 30 ,

Q 1 (4%)

, Q , Q

30

7% . 8 Q ,

1 (4%) 7 (26%)

8 33%,

(TLR) 26% .

결 론 :

가 .

중심 단어 :

REFERENCES

- 1) Serruys PW, de Jaegere P, Kiemenij F, Macaya C, Rutsch W, Heyndrickx G, et al. A comparison of balloon-expandable stent implantation with balloon angioplasty in patients with coronary artery disease. *N Engl J Med* 1994; 331:489-95.
- 2) Macaya C, Serruys PW, Ruygrok P, Suryapranata H, Mast G, Klugmann S, et al. Continued benefit of coronary stenting versus balloon angioplasty: One-year clinical follow-up of Benestent Trial. *J Am Coll Cardiol* 1996;27:255-61.
- 3) Fischman DL, Leon MB, Baim DS, Schatz RA, Savage MP, Penn I, et al. A randomized comparison of coronary-stent placement and balloon angioplasty in the treatment of coronary artery disease. *N Engl J Med* 1994;331:496-501.
- 4) Yokoi H, Kimura T, Nakagawa Y, Nosaka H, Nobuyoshi M. Long-term clinical and quantitative angiographic follow-up after the Palmaz-Schatz stent restenosis. *J Am Coll Cardiol* 1996;27:224A.
- 5) Dussaillant GR, Mintz GS, Pichard AD, Kent KM, Satler LF, Popma JJ, et al. Small stent size and intimal hyperplasia contribute to restenosis: A volumetric intravascular ultrasound analysis. *J Am Coll Cardiol* 1995;26:720-4.
- 6) Hoffmann R, Mintz GS, Dussaillant GR, Popma JJ, Pichard AD, Satler LS, et al. Patterns and mechanisms of in-stent restenosis: A serial intravascular ultrasound study. *Circulation* 1996;94:1247-54.
- 7) Deckelbaum LI, Natarajan MK, Bittl JA, Rohlfis K, Scott J, Chisholm R, et al. Effect of intracoronary saline infusion on dissection during excimer laser coronary angioplasty: A randomized trial. *J Am Coll Cardiol* 1995;26:1264-9.
- 8) Hoffmann R, Mintz GS, Mehran R, Pichard AD, Kent KM, Satler LF, et al. Intravascular ultrasound predictor of angiographic restenosis in lesions treated with Palmaz-Schatz stents. *J Am Coll Cardiol* 1998;31:43-9.
- 9) Mehran R, Mintz GS, Popma JJ, Pichard AD, Satler LF, Kent KM, et al. Mechanism and results of balloon angioplasty for the treatment of in-stent restenosis. *Am J Cardiol* 1996;78:618-22.
- 10) Mehran R, Abizaid AS, Mintz GS, Kent KM, Pichard AD, Satler LF, et al. Patterns of in-stent restenosis: Classification and Impact on subsequent target lesion revascularization. *J Am Coll Cardiol* 1998;31(2):141A.
- 11) Mehran R, Mintz GS, Satler LF, Pichard AD, Kent KM, Bucher T, et al. Treatment of in-stent restenosis with excimer laser coronary angioplasty: Mechanisms and results compared with PTCA alone. *Circulation* 1997;96:2183-9.
- 12) Koster R, Hamm CW, Terres W, Koschyk DH, Reimers J, Kahler J, et al. Treatment of in-stent coronary restenosis by excimer laser angioplasty. *Am J Cardiol* 1997;80:1424-8.
- 13) Lee SG, Lee CW, Cheong SS, Hong MK, Kim JJ, Park SW, et al. Rotational atherectomy versus balloon angioplasty for the treatment of in-stent restenosis. *Am J Cardiol* 1998;82:140-3.
- 14) Foley DP, Appelman YE, Piek JJ on the behalf of the AM-RO group. Comparison of angiographic restenosis propensity of excimer laser coronary angioplasty (ELCA) and balloon angioplasty in the AMsterdam ROTterdam (AM-RO) trial. *Circulation* 1995;92(8):I-477.
- 15) Vandormael M, Reifart N, Preusler W, Schwarz F, Storrer H, Hofmann M, et al. Six months follow-up results following Excimer Laser angioplasty, Rotational Atherectomy and Balloon Angioplasty for Complex Lesions: ERBAC study. *Circulation* 1994;90(4):I-213.