PCI for Chronic Total Occlusion
Chronic Total Occlusions

20-40% of patients with CAD

Why should we open?
Rationale for CTO Revascularization

• Long-term outcomes improvement
• LVEF improvement
• Electrical stability of myocardium
• Improved tolerance for future coronary events
# Long-term Outcomes for CTO Revascularization

<table>
<thead>
<tr>
<th></th>
<th>Single vessel</th>
<th></th>
<th>Multivessel</th>
<th></th>
<th></th>
<th></th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CTO success</td>
<td>CTO failure</td>
<td>P</td>
<td>CTO success</td>
<td>CTO failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 261)</td>
<td>(n = 99)</td>
<td></td>
<td>(n = 306)</td>
<td>(n = 205)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death (%)</td>
<td>97.3</td>
<td>99.0</td>
<td>0.3</td>
<td>92.5</td>
<td>86.3</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Death or MI (%)</td>
<td>94.6</td>
<td>96.0</td>
<td>0.6</td>
<td>88.6</td>
<td>82.0</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Death or CABG (%)</td>
<td>91.6</td>
<td>70.7</td>
<td>&lt;0.001</td>
<td>86.9</td>
<td>61.5</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>MACE (%)</td>
<td>72.0</td>
<td>47.5</td>
<td>&lt;0.001</td>
<td>61.1</td>
<td>42.9</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

# Predictors for Long-Term Mortality

*Mid-America Heart Institute, JACC 2001*

<table>
<thead>
<tr>
<th>Variables</th>
<th>HR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success</td>
<td>0.7</td>
<td>0.5-0.8</td>
</tr>
<tr>
<td>Age &gt; 70</td>
<td>1.9</td>
<td>1.5-2.4</td>
</tr>
<tr>
<td>EF &lt; 40%</td>
<td>2.1</td>
<td>1.7-2.7</td>
</tr>
<tr>
<td>2 vessel disease</td>
<td>1.5</td>
<td>1.1-2.2</td>
</tr>
<tr>
<td>3 vessel disease</td>
<td>1.9</td>
<td>1.4-2.7</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.4</td>
<td>1.1-1.8</td>
</tr>
<tr>
<td>Creatinine &gt; 2.0mg/dl</td>
<td>2.2</td>
<td>1.3-3.9</td>
</tr>
<tr>
<td>Unstable angina</td>
<td>1.3</td>
<td>1.1-1.6</td>
</tr>
</tbody>
</table>
## Predictors for Long-Term Mortality

*British Columbia Cardiac Registries, TCT 2003*

<table>
<thead>
<tr>
<th>Variables</th>
<th>HR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success</td>
<td>0.4</td>
<td>0.3-0.6</td>
</tr>
<tr>
<td>Age (per 10)</td>
<td>1.3</td>
<td>1.1-1.6</td>
</tr>
<tr>
<td>EF &lt; 50%</td>
<td>2.3</td>
<td>1.6-3.4</td>
</tr>
<tr>
<td>Multivessel disease</td>
<td>1.6</td>
<td>1.1-2.4</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.5</td>
<td>0.9-2.3</td>
</tr>
<tr>
<td>End stage renal disease</td>
<td>2.8</td>
<td>1.4-5.7</td>
</tr>
<tr>
<td>Prior heart failure</td>
<td>1.7</td>
<td>1.1-2.8</td>
</tr>
<tr>
<td>Peripheral vascular disease</td>
<td>1.9</td>
<td>1.1-3.6</td>
</tr>
<tr>
<td>Chronic obstructive lung disease</td>
<td>1.6</td>
<td>1.1-2.7</td>
</tr>
</tbody>
</table>
# Independent Predictors of Long-term Death and MACE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>HR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Death</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Successful revascularization</td>
<td>0.58</td>
<td>0.34–0.98</td>
<td>0.04</td>
</tr>
<tr>
<td>Age</td>
<td>1.04</td>
<td>1.02–1.07</td>
<td>0.002</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>2.49</td>
<td>1.33–4.66</td>
<td>0.005</td>
</tr>
<tr>
<td>Multivessel disease</td>
<td>4.29</td>
<td>1.93–9.55</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>MACE</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Successful revascularization</td>
<td>0.55</td>
<td>0.44–0.70</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Multivessel disease</td>
<td>1.43</td>
<td>1.14–1.79</td>
<td>0.002</td>
</tr>
<tr>
<td>Use of a stent</td>
<td>0.69</td>
<td>0.54–0.88</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Issues in CTO Intervention

- Very dangerous
- Low procedural success
- High restenosis rate
Issues in CTO Intervention

- Very dangerous
- Low procedural success
- High restenosis rate
Possibility of High Complication

- Impairment of collateral flow
  - spasm, shearing off side-branches and collateral by dissection, distal embolization
- Retrograde dissection with branch occlusion or perforation
  - intra-wall balloon expansion, side-branch dilatation, damage of neochannels connecting vasa vasorum
- Guidewire entrapment
- Subacute vessel reocclusion
  - 8% of total occlusion within 24hr Vs. 1.8% of non total occlusion
- Extensive contrast use and fluorescence time
In-Hospital Major Complication

Not dangerous!

CTO (n=2007) vs. Non-CTO (n=2007)

All p=NS

Issues in CTO Intervention

- Very dangerous
- Low procedural success
- High restenosis rate
Reasons for PCI failure in CTO

- Passage failure of guidewire 63%
- Long intimal dissection 24%
- Dye extravasation 11%
- Balloon did not cross or dilate 2%
- Thrombus 1.2%

Predictors of Procedural Success

- Duration of occlusion
- Length of occluded lesion
- Presence of a non-tapered stump
- Origin of a side branch at occlusion site
- Vessel and lesion tortuosity and calcification
- Absence of antegrade flow
- Ostial occlusion
- Bridging collateral
## Predictors of Procedural Success

Multivariate analysis from TOAST-GISE

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hazard Ratio</th>
<th>$P$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length $\geq 15$ Vs. $&lt;8$ mm</td>
<td>3.9</td>
<td>0.028</td>
</tr>
<tr>
<td>Length not measurable Vs. $&lt;8$ mm</td>
<td>3.8</td>
<td>0.019</td>
</tr>
<tr>
<td>Moderate to severe calcification</td>
<td>3.5</td>
<td>0.023</td>
</tr>
<tr>
<td>Duration $\geq 180$ days</td>
<td>3.1</td>
<td>0.013</td>
</tr>
<tr>
<td>Multivessel disease</td>
<td>2.3</td>
<td>0.009</td>
</tr>
<tr>
<td>Stump morphology not discernable</td>
<td>2.2</td>
<td>0.048</td>
</tr>
</tbody>
</table>

*Olivari Z, et al. JACC 2003;41:1672-1678*
## Predictors for Procedural Success

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>OR</th>
<th>95% C.I.</th>
<th>P</th>
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<tbody>
<tr>
<td><strong>Morphology</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Abrupt</td>
<td>187</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tapered</td>
<td>96</td>
<td>6.1</td>
<td>2.1-18.2</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Angulation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 45</td>
<td>12</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>≤ 45</td>
<td>271</td>
<td>4.5</td>
<td>1.2-17.2</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Missing segment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 15 mm</td>
<td>123</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>&lt; 15 mm</td>
<td>160</td>
<td>34</td>
<td>1.6-7.0</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Single Lesion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>134</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>No</td>
<td>149</td>
<td>2.2</td>
<td>1.1-4.4</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Easy vs. Hard CTO

- Straight vessel
- Stump present
- Short lesion
- Convex type
- No side branch

- Tortous vessel
- No stump
- Long lesion
- Tapered type
- Small side branch
How to improve procedural success?

- Better guiding support
- Smart guidewire
- New device
- Technical advancement
Improved Success Rate

- No tapered tip
- Stepwise guidewire technique
- New guidewire: Conquest etc
- Double wire technique

1039 lesions, 934 patients

1995-1996: 64.6%
1996-1998: 67.9%
2001: 81.0%
2004: 87.7%

P<0.001

P=0.029

Hiroyuki Tanaka, et al. ACC 2005
How to improve procedural success?

• Better guiding support
• Smart guidewire
• New device
• Technical advancement
Guiding Catheter for CTO

7F TFI with all Side Hole

- Left Coronary Artery
  - LAD: EBU 3.5, EBU 4.0
  - LCX: AL 1.0, 1.5
- Right Coronary Artery
  - AL 0.75, 1.0

Strong Back up support
Guiding Catheter for RCA
Two Guiding Catheter for RCA

- 6F for 5F Guiding Catheter
- 8F Guiding Catheter
- balloon
Guiding Catheter for LCA

AL2

LAD

JL

AL
Position of Support Catheter

RAO

LAO Caud
How to improve procedural success?

- Better guiding support
- Smart guidewire
- New device
- Technical advancement
New Technologies for CTO

- **Dedicated guidewires**
  - Hydrophilic guidewire
  - Tapered-tip guidewire: Cross-IT, Conquest, Miracle
  - Guidewire manipulation by microchannel guidance
  - Re-entry technique
- **New devices**
  - FrontRunner™ Catheter
  - OCR SafeSteer™ System
  - Flow Cardia Crosser™ System
- **Biological approach**
  - Prolonged urokinase/tPA infusion
  - Collagenase plaque digestion
Guide Wire for CTO

- **Spring type**
  - General use: Route, Rinato, TGV, ATW
  - Stiff type: Miracle, Conquest, TGV standard, Magic
  - Nitol type: Runthrough, BMW, Balance

- **Plastic type**
  - Choice PT, Whisper, Fielder
# Ability to Cross CTO

## Hydrophilic-coated Guidewire

<table>
<thead>
<tr>
<th></th>
<th>Conventional (n=46)</th>
<th>Crosswire (n=42)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st GW success (%)</td>
<td>35</td>
<td>74</td>
<td>0.001</td>
</tr>
<tr>
<td>Crossover (%)</td>
<td>59</td>
<td>26</td>
<td>0.009</td>
</tr>
<tr>
<td>GW success after crossover (%)</td>
<td>37</td>
<td>0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total GW No.</td>
<td>1.7 ± 0.6</td>
<td>1.3 ± 0.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Procedure (min)</td>
<td>84 ± 33</td>
<td>42 ± 20</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Lefevre et al, Am J Cardiol 2000;85:1144-7
Ability to Cross CTO

Tapered guidewire

- Technical success: 76%
- Success rate in visible microchannel
  - incomplete micro-channel: 81%
  - micro-channels with distal filling: 100%

Buettner HJ, et al. JACC 2002;39:30A
Special Devices for CTO Recanalization

- Failed special device
  - Magum/Magnarail system
  - Kensey Catheter
  - ROTACS Low Speed Rotational Atherectomy Catheter
  - Excimer Laser Wire

- CTO device in current use
  - OCR SafeSteer™ System
    (Optical Coherence Reflectometry)
  - FrontRunner™ Catheter
  - Flow Cardia Crosser System
OCR SafeSteer System

• *Forward looking guidance system*, using OCR to determine tissue types (*plaque vs arterial wall*).

• Designed to navigate through total occlusion.
OCR SafeSteer System

OCR Waveform Displays
GREAT Registry

116 Lesions 21 centers with CTO “failure to cross”
median occlusion duration: 22 months
Median lesion length: 25mm (>30mm long in 25%)

- Device Success 63 (54.3%)
- Complication
  - MACE in hospital 8 (6.9%)
  - Non-Q MI 5 (5.2%)
  - Clinical perforation 3 (2.6%)
  - Device related 1 (0.9%)

Baim DS et al. Am J Cardiol 2004;94:853-858
FrontRunner Catheter

Controlled Blunt Micro-Dissection

- Blunt controlled passage through occlusion
- Uses elastic properties of adventitia vs. inelastic fibrocalcific plaque
FrontRunner Catheter

**Advantages**
- Torqueable
- Guide support
- Directable/Steerable
- Hydrophilic coating
- Blunt tip to avoid perforation
- Avoids side branches

**Disadvantages**
- Difficult anatomy: tortuosity, small vessel, heavy calcium
- Expensive
- 8 Fr guiding for curved jaw
- Failure Modes
Clinical Outcomes of FrontRunner Catheter

- **N = 909**
  - Pre-approval phase: 119 (using the largest device),
  - Post-approval phase: 197 (using a smaller, more flexible catheter),
  - Current design: 593 (using X-39 Frontrunner)
- **Lesion length**: >30mm in 21%
- **Success rate**
  - Pre-approval phase: 56%
  - Post-approval phase: 59%
  - Current design: 61%
- **Perforation**: 0.9%

FrontRunner Catheter
Milan Experiences

50 pts with 50 CTO, Refractory to guidewire
Mean occlusion length 38.3 ± 22 mm

• Overall Device Success 50 % (25)
• Coronary perforation 17.3 % (9)
• Adverse events @ 30 days 15.7 % (8)
  7 non-Q wave MI, 1 sudden death

Relatively high risk of perforation!

A Colombo et al, ACC 2004
The Crosser™ System

- **Generator** converts line power into high frequency current
- **Transducer** converts electric current into mechanical vibration
- **The Crosser catheter**
The Crosser™ System

Clinical Experiences

54 pts with 56 CTO, Refractory to guidewire
Mean occlusion length 27 mm (8~46 mm)

- Average time spent 2:43 min
- MACE (2 NQMI) 3.6 % (2/56)
- Clinical perforation 0 %

High frequency mechanical recanalization is a promising technology.

G. Sutsch et al, JIM 2004
How to improve procedural success?

- Better guiding support
- Smart guidewire
- New device
- Technical advancement
Technical Advancement

Conventional Technique

- Bilateral angiography
- Over-the-wire catheter
- Collateral angiography
- Biplane angiographic equipment
- Stepwise guidewire exchange
Technical Advancement

New Techniques

- Parallel wire technique
- Side branch technique
- Sub-intimal re-entry technique
- IVUS-guided recanalization technique
- Seesaw wiring technique
- Retrograde Wiring
- Micro-catheter
- Penetrating catheter
CONQUEST trial

Stepwise guidewire change

- Prospective Multicenter Registry in Japan
- Method: stepwise guidewire change
  - First step: intermediate GW
  - Second step: Conquest GW series
  - Third step: additional Conquest GW, Seesaw wire technique

T. Muramatsu, et al. TCT 2004
CONQUEST trial

110 patients, 116 CTO lesions

Final success in 90.5%

Success rate (%)

One step
Two step
Three step

T. Muramatsu, et al. TCT 2004
Side Branch Technique
Parallel Wire Technique
Stop When...

- Creation of a large false lumen, especially if adventitial staining is present
- Shearing off collateral resulting in loss of visualization of the distal flow
- Excessive patient or operator fatigue
- Excessive radiation exposure (e.g. 60 min of fluroscopy time)
- Excessive dye consumption

→ Second try at 6-8 weeks later
# Evolution of CTO Treatment

| Guidewire          | Tapered tip: CROSS IT, Conquest, Miracle  
|                   | Steerable guidewire  
|                   | Optical coherence reflectometry  
| Ablation          | Excimer laser  
|                   | Ultrasound  
|                   | Radiofrequency ablation  
| Mechanical        | Blunt microdissection  
|                   | Fibrinolysis  
|                   | Demineralization, Collagenase  
| Re-entry          | Percutaneous bypass  
| Post-crossing     | Drug eluting stents  
|                   | Distal protection  |
# Usefulness of Multi-slice CT For PCI of CTO

<table>
<thead>
<tr>
<th></th>
<th>With MSCT</th>
<th>Without MSCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st procedure success</td>
<td>88.2 % (30/34)</td>
<td>69.2 % (19/26)</td>
</tr>
<tr>
<td>Final lesion success</td>
<td>94.1 % (32/34)</td>
<td>82.6 % (19/23)</td>
</tr>
<tr>
<td>Median fluoro time (min)</td>
<td>32.4</td>
<td>49.6</td>
</tr>
<tr>
<td>Used contrast volume (ml)</td>
<td>258</td>
<td>287</td>
</tr>
</tbody>
</table>

*Satoru Sumitsuji, et al. ACC 2006.*
Results of PCI for CTO

DES vs. BMS
CTO vs. Non-CTO from BMS to DES

Fujita et al. ACC 2006
Long-term Durability of DES for CTO

Werner et al. ACC 2006

Late reocclusion: Taxus (n=95) 1.3%, BMS (n=148) 21.4%, P<0.001

1 year MACE: Taxus 16.0%, BMS 56%, P<0.001

2 year MACE: Taxus 18.0%, BMS 66%, P<0.001
Acute Gain & Late Loss

Cypher vs. BMS

Cypher (n=104) vs. BMS (n=75)

Acute gain

- Cypher: 2.70 mm
- BMS: 2.80 mm
- P = 0.066

Late loss

- Cypher: 0.40 mm
- BMS: 1.10 mm
- P < 0.001

MK Kim et al. J Interv Cardiol 2006 (in print)
**Chronic Total Occlusion**

**Cypher vs. BMS**

- **Reocclusion**
  - Cypher (n=104): 2.2%
  - BMS (n=75): 12.2%
  - P = 0.069

- **Restenosis**
  - Cypher (n=104): 8.7%
  - BMS (n=75): 32.6%
  - P = 0.006

*MK Kim et al. J Interv Cardiol 2006 (in print)*
Historical Comparison

6 Month Restenosis Rate

- **TOSCA** (n=179): 55%
- **STOP** (n=48): 42%
- **GISSOC** (n=56): 32%
- **SICCO** (n=57): 32%
- **RESEARCH** (n=33): 9%
- **AMC** (n=46): 9%

Serruys et al, ACC 2004
Results of PCI for CTO

DES Registry
# CTO Representation in DES Trials

<table>
<thead>
<tr>
<th>Trial</th>
<th>N</th>
<th>CTO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARRIVE</td>
<td>2,586</td>
<td>1.8</td>
</tr>
<tr>
<td>DIABETES</td>
<td>221</td>
<td>13.1</td>
</tr>
<tr>
<td>e-Cyper</td>
<td>14,316</td>
<td>2.9</td>
</tr>
<tr>
<td>WISDOM</td>
<td>903</td>
<td>7.0</td>
</tr>
</tbody>
</table>
## Angiographic and Clinical Outcomes

### DES in CTO treatment

<table>
<thead>
<tr>
<th>Trial</th>
<th>Type</th>
<th>Lesion</th>
<th>Follow-up</th>
<th>Restenosis</th>
<th>TVR</th>
<th>MACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nakamura</td>
<td>SES</td>
<td>60</td>
<td>6 Mo</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>AJC 2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suarez de Lezo</td>
<td>SES</td>
<td>86</td>
<td>6 Mo</td>
<td>13%</td>
<td>6%</td>
<td>NA</td>
</tr>
<tr>
<td>ACC 2003</td>
<td></td>
<td></td>
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<tr>
<td>Hoye</td>
<td>SES</td>
<td>56</td>
<td>6 Mo angio</td>
<td>9.1%</td>
<td>3.6%</td>
<td>3.6%</td>
</tr>
<tr>
<td>JACC 2004</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>SICTO</td>
<td>SES</td>
<td>25</td>
<td>6M TVR</td>
<td>NA</td>
<td>8.0%</td>
<td>NA</td>
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<tr>
<td>EuroPCR 2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Werner</td>
<td>PES</td>
<td>48</td>
<td>6 Mo angio</td>
<td>8.3%</td>
<td>6.3%</td>
<td>12.5%</td>
</tr>
<tr>
<td>JACC 2004</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Results of PCI for CTO

Cypher vs. Taxus
## Angiographic and Clinical Outcomes

### Cypher vs. Taxus in CTO treatment

<table>
<thead>
<tr>
<th></th>
<th>Cypher (n=128)</th>
<th>Taxus (n=180)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural success</td>
<td>100%</td>
<td>100%</td>
<td>NS</td>
</tr>
<tr>
<td>30 days MACE</td>
<td>0%</td>
<td>0%</td>
<td>NS</td>
</tr>
<tr>
<td>Reference diameter, mm</td>
<td>2.90±0.88</td>
<td>2.82±0.90</td>
<td>NS</td>
</tr>
<tr>
<td>MLD post, mm</td>
<td>2.80±0.80</td>
<td>2.73±0.81</td>
<td>NS</td>
</tr>
<tr>
<td>MLD 12 month, mm</td>
<td>2.73±0.80</td>
<td>2.63±0.77</td>
<td>NS</td>
</tr>
<tr>
<td>Restenosis 12 months</td>
<td>1.5%</td>
<td>1.7%</td>
<td>NS</td>
</tr>
<tr>
<td>TVR</td>
<td>2.3%</td>
<td>2.2%</td>
<td>NS</td>
</tr>
<tr>
<td>MACE 12 months</td>
<td>2.3%</td>
<td>2.2%</td>
<td>NS</td>
</tr>
</tbody>
</table>

Nakamura, et al, TCT 2004
### Angiographic and Clinical Outcomes

**Cypher vs. Taxus in CTO treatment**

<table>
<thead>
<tr>
<th></th>
<th>Cypher (n=111)</th>
<th>Taxus (n=105)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural success</td>
<td>100%</td>
<td>100%</td>
<td>NS</td>
</tr>
<tr>
<td>Reocclusion</td>
<td>6%</td>
<td>7.5%</td>
<td>1.0</td>
</tr>
<tr>
<td>Restenosis</td>
<td>24.3%</td>
<td>23.5%</td>
<td>0.84</td>
</tr>
<tr>
<td>Late loss, mm</td>
<td>0.47±1.12</td>
<td>0.68±1.35</td>
<td>0.36</td>
</tr>
<tr>
<td>TLR</td>
<td>14.4%</td>
<td>14.3%</td>
<td>1.0</td>
</tr>
<tr>
<td>TVR</td>
<td>17.1%</td>
<td>18.1%</td>
<td>0.86</td>
</tr>
</tbody>
</table>

*Melzi, et al, ACC 2006*
# Chronic Total Occlusion

## Cypher vs. Taxus

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cypher (n=107)</th>
<th>Taxus (n=29)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural success</td>
<td>100%</td>
<td>100%</td>
<td>NS</td>
</tr>
<tr>
<td>Lesion length, mm</td>
<td>$36.5 \pm 20.3$</td>
<td>$28.0 \pm 15.6$</td>
<td>0.23</td>
</tr>
<tr>
<td>Number of stents</td>
<td>$1.8 \pm 0.8$</td>
<td>$1.7 \pm 0.9$</td>
<td>0.51</td>
</tr>
<tr>
<td>Stent length, mm</td>
<td>$48.6 \pm 24.4$</td>
<td>$45.0 \pm 25.4$</td>
<td>0.48</td>
</tr>
<tr>
<td>Reference diameter, mm</td>
<td>$2.9 \pm 0.5$</td>
<td>$3.1 \pm 0.4$</td>
<td>0.15</td>
</tr>
<tr>
<td>MLD post-procedure, mm</td>
<td>$2.7 \pm 0.4$</td>
<td>$2.9 \pm 0.3$</td>
<td>0.007</td>
</tr>
<tr>
<td>MLD follow-up, mm</td>
<td>$2.3 \pm 0.8$</td>
<td>$2.0 \pm 0.9$</td>
<td>0.173</td>
</tr>
</tbody>
</table>

*JS Jang et al. Int J Cardiol 2006 (in print)*
Acute Gain & Late Loss

Cypher vs. Taxus

<table>
<thead>
<tr>
<th></th>
<th>Acute gain</th>
<th>Late loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cypher</td>
<td>2.60</td>
<td>0.40</td>
</tr>
<tr>
<td>Taxus</td>
<td>2.80</td>
<td>0.80</td>
</tr>
</tbody>
</table>

P=0.009

P=0.025

JS Jang et al. Int J Cardiol 2006 (in print)
Chronic Total Occlusion
Cypher vs. Taxus

Restenosis
Cypher (n=107) vs. Taxus (n=29)
P = 0.020

MACE
Cypher (n=107) vs. Taxus (n=29)
P = 0.069

JS Jang et al. Int J Cardiol 2006 (in print)