My idea on intimal tracking
guide wire selection for Pop-BTK treatment

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Crossing CTO’s

- Guidewire technology
- Crossing techniques
Guidewire technology

The Three Most Important Design Features that Impact Performance

**Distal Tip**
- Tip Load
- Spring Coil
- Taper
- Coating

**Core**
- Thickness
- Material
- Smooth or Abrupt Taper

**Coating**
- Hydrophilic + Polymer
- Hydrophilic on Spring Coil
- Hydrophobic
- Uncoated Distal Tip
Understanding guidewires

Tip Load – measurement of tip stiffness at 1cm

Spring Coil – helps transmit torque

Tapering of the core and the tip provides more penetration

Coating enhances or detracts from tactile feedback

TRADE OFF:
The higher the tip load, the better the penetration but the more that wire wants to go straight and will not track the vessel

Distal Tip
Tip Load
Spring Coil
Taper
Coating
**Understanding guidewires**

### Core

- **Thickness**
  - **Thick core** wire is more supportive and transmits torque better (except in tortuous anatomy)
  - **Thin core** wire tracks more easily

- **Material**
  - **Nitinol** is more durable but harder to shape and doesn’t transmit torque as well
  - **Stainless steel** transmits torque better but is less durable

- **Smooth vs Abrupt taper**
  - A wire with a smooth taper tracks better

**TRADE OFF:**
- The thicker the core, the better the torque and durability but the more the wire wants to go straight
Understanding guidewires

**Coating**
- Hydrophilic + Polymer
- Hydrophilic on Spring Coil
- Hydrophobic
- Uncoated Distal Tip

**Hydrophilic + Polymer Sleeve** – most lubricious

**Hydrophilic on Spring Coil** – balance between lubricity and tactile feel

**Hydrophobic on Spring Coil** – least lubricious

**TRADE OFF:**
You sacrifice tactile feel for lubricity

**Uncoated distal tip** – provides some tactile feedback while maintaining lubricity
The polymer fills the gap and reduces the contact resistance. By applying a hydrophilic coating on the polymer, the wire is easier to advance.
20th century wire construction

1-piece: All stainless steel core from proximal to distal

2-piece: Stainless Steel Shaft and Ni-Ti tip

3-piece: Stainless Steel Shaft and Ni-Ti tip and stainless steel ribbon
# Crossing techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Indication</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antegrade Standard/sliding</td>
<td>Softer and less calcified lesion, microchannel, or subtotal lesion</td>
<td>Less traumatic.</td>
<td>Possible low success rate, not suitable for hard lesions.</td>
</tr>
<tr>
<td>Drilling</td>
<td>Short segment occlusion</td>
<td>High chance of intraluminal crossing.</td>
<td>Not suitable for long occlusions or complex cases. Modulating the strength of the drilling motion limits the risk of perforation, but also limits the chance of success.</td>
</tr>
<tr>
<td>Penetration</td>
<td>Hard or calcified lesion, reentry from the subintimal space into true lumen</td>
<td>Increases the success rate of antegrade crossing.</td>
<td>Potential risk of vessel perforation.</td>
</tr>
<tr>
<td>Parallel wire</td>
<td>Any situation</td>
<td>Increases the success rate of antegrade crossing.</td>
<td>Need for multiple guidewires. Risk of compromising branches or being stuck in the calcified lesion. Potential failure of reentry into the true lumen.</td>
</tr>
<tr>
<td>J-loop, knuckle wire, subintimal angioplasty</td>
<td>Long occlusion</td>
<td>Increased success rate of antegrade crossing. Rapid traversal of long total occlusions, less likely to cause vessel perforation.</td>
<td></td>
</tr>
<tr>
<td>Retrograde Distal tibial or dorsalis pedis artery puncture</td>
<td>Preserved distal vessel</td>
<td>Stronger backup force to cross the lesion.</td>
<td>Potential risk of puncture site occlusion during the procedure or during follow-up.</td>
</tr>
<tr>
<td>Transcollateral</td>
<td>Unavailable reconstituted vessel and sufficient collateral vessel</td>
<td>No need for retrograde puncture.</td>
<td>Insufficient backup force. Potential risk of injury to the collateral vessel.</td>
</tr>
<tr>
<td>Transpedal arch</td>
<td>No distal vessel available</td>
<td>Possibility of complete revascularization.</td>
<td>Potential risk of compromising branches in the foot and injury of the pedal arch.</td>
</tr>
<tr>
<td>Metatarsal or plantar artery puncture</td>
<td>Occlusion of the pedal arch</td>
<td>Possibility of revascularization of the dorsalis pedis artery or plantar artery.</td>
<td>Failed procedure resulting in urgent worsening of underlying toe ischemia.</td>
</tr>
<tr>
<td>CART, reverse CART, rendezvous, confluent balloon, kissing wire</td>
<td>Failed reentry using conventional techniques</td>
<td>Increases the success rate of guidewire crossing.</td>
<td>Need for further dedicated devices.</td>
</tr>
</tbody>
</table>

CART: Controlled antegrade and retrograde tracking.
Sliding technique

- Ideal for soft lesions
- Tapered tip needed to increase likelihood of finding microchannels

Kawarada O et al, JET 2014;21:266-280
Drilling

• Requires tactile feel of torque response
Penetration technique proximal and distal cap

• Requires high penetration power and tip load
J-loop technique

- Knuckle wire intraluminal (lambda)
- Subintimal tracking
- Requires soft hydrophilic tip

Kawarada O et al, JET 2014;21:266-280
Common features

• Lack of control (wire will go where it wants to go)
• Difficult to stay intraluminal
• Proper orientation in one plane, does not necessarily mean proper orientation in the other
Simulation model

Lesion length: 10cm
Lesion Diameter: 7mm
Crossing in AP view

Old wire technology
Crossing in bidirectional view

Old wire technology
21st century wire construction

- Round core
- Less Torque Whip
- Better Torque Response
- Protect Core From Kinking
- Increases Torque Force

ACTONE
21st century wire construction

Tapered Tips & Pre-shaping

Micro-cone Tip

Mini Pre-shape

VS
Essentials

• Cap penetration
  – Facilitated by micro-cone tip and mini pre-shape

• Intra-luminal crossing (intimal tracking)
  – Re-entry maybe difficult
  – Completely different approach
  – Learn to think in 2 dimensions, because now you have the tools!
Cap penetration
Intimal tracking

PTA Guide wire for treating tight occluded lesion with strong torque force

By using deflection & control

Stiffness + Torque
Intimal tracking: concept

To guide the wire through the occlusion to the distal lumen by using deflection and rotational control.

<table>
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<tr>
<th>Approach the lesion</th>
<th>Penetrability</th>
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<tr>
<td>Change the route</td>
<td>Tip flexibility</td>
</tr>
<tr>
<td></td>
<td>Tip shape durability</td>
</tr>
<tr>
<td>Using deflection &amp;</td>
<td>Torque performance</td>
</tr>
<tr>
<td>Rotational control</td>
<td>Torque</td>
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<tr>
<td></td>
<td>Response</td>
</tr>
<tr>
<td></td>
<td>Lubricity</td>
</tr>
</tbody>
</table>

You guide the wire!
Intimal tracking

You guide the wire!
Deflection and directional control

Guiding the wire to the distal true lumen with rotational control by using deflection which occurs when advancing a shaped GW.

What does Deflection mean?
Crossing in bidirectional view

New wire technology
Summary

- Make the step of 2D to 3D, and think 3D
- Be in control
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