Novel BioResorbable Vascular Platforms from India

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Disclosure

I do not have any potential conflict of interest.
Current Tx of PVD – Metal Stent Technologies in Abundance
Limitation of Existing Technologies
The Intuitive Desire in Stenting

- STEMI
- Bifurcation
- CTOs
- Carotid
- Renal
- Iliac

Un-caging the vessel wall
The Intuitive Promise of BRS

**Leave Nothing Behind**

- Un-caging the vessel & restoration of vascular function
- Avoid, positive remodeling of the treated vessel/malapposition
- Avoid/resolve late strut fractures
- Facilitation of repeat treatment – Surgical or Angioplasty
- Restoration of normal vessel curvature
- In-stent restenosis. No need to leave behind more metal
- Early discontinuation of DAPT
- MRI/CT imaging follow-up. No hospital admissions.
- Imminent surgical cases
- Plaque regression. Reduced neoatherosclerosis
- Reduced costs on the system
Credence BtK – Sirolimus Eluting BRS

- **Size Matrix** – 63 SKUs
  - **Diameters** – 2.50, 2.75, 3.00, 3.25, 3.50, 4.00, 4.50 mm
  - **Lengths** – 8, 13, 16, 19, 24, 29, 32, 37, 40 mm

- **Hybrid cell design**
- **Scaffold backbone PLLA 100 μm strut thickness**
- **Optimal side branch access**
- **Low profile, 1.2 mm & deliverable system**
- **24% scaffold to artery ratio**
- **High radial strength, 22.30 N**
- **Low recoil, 1.23%**
- **Couplets of tri-axial RO markers at either end**
- **High vessel conformability**
- **Estimated degradation in 2-3 years**
- **Drug coat of PDLLA + Sirolimus 1.25 μg/mm²**
- **Low balloon overhang, short, abrupt balloon shoulders**

Data on file.
Hydrolysis occurs via random chain scission of the ester bond. Hydrolysis randomly cleaves amorphous tie chains, leading to a decrease in molecular weight without altering radial strength. When enough tie chains are broken, the device begins losing radial strength.
Credence BtK – Degradation

- Credence BtK is manufactured from a high molecular weight of 275-300 kDa of PLLA.
- Degradation is led by hydrolysis and entire scaffold is consumed over a period of 2-3 years.

- Hydrolysis occurs via random chain scission of the ester bond.
- Factors affecting hydrolysis – polymer chemistry, enzymatic activity, temperature, implant dimensions, local pH
- Water can only penetrate the amorphous phase.
- Hydrolysis of amorphous tie chains leads to an erosion of radial strength.
Wide Range of Novel BRS Platforms – Extending Clinical Plasticity of PLLA
Credence BtK –
Sirolimus Eluting Bioresorbable Peripheral Scaffold System

Scaffold Architecture
• Scaffold design : Hybrid design
• Back bone : PLLA
• Strut thickness : 100 μm
• Top coat : PDLLA + Sirolimus
• Coating thickness : 3-4 μm
• Sirolimus loading : 1.25 μg/mm²
• RO markers : Tri-axial couplets at each end
• Scaffold surface area : 230.7 mm² (3.00 x 29 mm)

Average Crimped Profile, 1.30 mm

Data on file.
Credence BtK – Study Design

PI: Dr. Gireesh Warawdekar (India) &
Co-PI: Dr. Vimal Someshwar (India)

First-in-man Safety and Efficacy in Patients Critical Limb
Ischemia disease due to de novo lesions (length ≤56 mm) in below
the knee arteries treated by a Credence BtK in 30 pts

Study:
Prospective, open label, single arm study.

Clinical Endpoints:
Absence of clinical complications at 1 month post-procedure.
Scaffold thrombosis as per ARC definition up to 5 years.
Key Eligibility Criteria

**Key Inclusion Criteria**
- Age $\geq 18$ years
- Stenotic (>50%) or occlusive atherosclerotic disease of the below the knee arteries
- Length of lesion $\leq 56$ mm
- Reference vessel diameter 2.25–4.50 mm
- A maximum of two lesions in one below the knee vessel treated in the study, or in two vessels of two different legs
- Symptomatic Critical Limb Ischemia (Rutherford 4 and 5)
- Life expectancy of $>6$ months

**Key Exclusion Criteria**
- Reference segment diameter not suitable for available scaffold size matrix
- Length of lesion requiring more than one scaffold implantation
- Previously implanted stent(s) or PTA at the same lesion site
- Lesion lying within or adjacent to an aneurysm
- Inflow-limiting arterial lesions left untreated
- Patient history of prior life-threatening contrast medium reaction
• **Safety**
  - Absence of clinical complications at 1 month post-procedure
  - Scaffold Thrombosis as per ARC definition up to 5 years

• **Performance Endpoints**
  - Technical success at 48 hrs & clinical success at each follow-up
  - Limb salvage rates at 6 & 12 months
  - Primary patency rate at 1 month, 1, 2, 3, 4 and 5 years
  - Target lesion revascularization (TLR) at 1 month, 6 months, 1, 2, 3, 4 and 5 years
  - Improvement of Ankle-Brachial Index (ABI)

• **Angiographic Endpoints**
  - Late Lumen Loss (LLL) diagnosed at 6 month
  - Primary patency at 6 months
Popliteal Artery Stenosis

69 Y/M | Diabetic | Hypertensive | Gangrene in Rt. II Toe | RF Class-4 | ABI-0.57

Pre-Procedure

Peri-Procedure

Post-Procedure

Data on file.
Popliteal Artery Stenosis

76 Y/M | Diabetic | Hypertensive | Gangrene in Rt. II Toe and Rt. Heel | RF Class-4 | ABI-0.63

Data on file.
Credence BRS –
Sirolimus Eluting Bioresorbable Peripheral Scaffold System

• Fully biodegradable scaffold – PLLA back-bone
• Top coat comprising of Sirolimus (1.25 μg/mm²) + PDLLA
• 3 tri-axial RO markers at each end of the scaffold
• 6 F sheath 0.035” guide wire; 135 cm catheter length
• Size matrix –
  – Diameters (mm) : 5.00, 6.00, 7.00, 8.00, 9.00, 10.00
  – Lengths (mm) : 17, 27, 37, 47, 57
• Credence BRS is currently under FiM Clinical Study in India

OCT Images Courtesy Skirball Center, NY, US. Dr. Greg Kaluza, Dr. Juan Granada et al. Data on file.
Credence BRS – Study Design

PI: Dr. Vimal Someshwar (India)

First-in-man Safety and Efficacy in patients two de novo peripheral artery lesion, in two different vessels lesion length (≤ 70 mm) treated by a Credence BRS in 30 pts

Study: Prospective, open label, single arm study.

Clinical Endpoints: Major Adverse Events (MAEs) up to 5 years, MAE rate is defined as all causes of death, target limb major amputation and/or TLR.
Melange BRS – Sirolimus Eluting Bioresorbable Renal Scaffold System

- Fully biodegradable scaffold – PLLA back-bone
- Top coat comprising of Sirolimus (1.25 μg/mm²) + PDLLA
- 3 tri-axial RO markers at each end of the scaffold
- 0.014” g/w; 6 F sheath compatible; 135 cm catheter length
- Size matrix –
  - Diameters (mm) : 5.00, 6.00, 7.00
  - Lengths (mm) : 12, 15, 19

- Melange BRS is currently under FiM Clinical Study

Melange Renal BRS 5.0x12 mm in Porcine Rt. Renal Artery

Baseline

30-day follow-up

OCT Images Courtesy Skirball Center, NY, US. Dr. Greg Kaluza, Dr. Juan Granada et al. Data on file.
Promesa BRS –
Braided Peripheral BioResorbable Scaffold

Unmet Clinical Need
• A drug eluting BioResorbable peripheral scaffold system which ensures fracture free, long term patency

Device Description
• Drug Eluting Self-Expanding BioResorbable Peripheral OTW Scaffold
  • Diameters: 3.00 to 10 mm
  • Lengths: 20 to 200 mm
• Employs 3.0 μg/mm² of Sirolimus timed to elute from a biodegradable polymer platform
• Low profile for ease in navigation
• Ideal for treatment of carotids, SFA, popliteal, iliac and below the knee lesions

Data on file.
Promesa BRS – Flexibility Demonstration

Data on file.
Conclusion

• The current generation of metal stents for treatment of peripheral vascular disease have their definite disadvantages – restenosis, strut fractures, aneurysms etc are commonly associated with metal stents.

• The concept of Bioresorbable vascular scaffolds with a promise of leaving nothing behind is clinically compelling.

• First generation of indigenously developed Peripheral BRS technologies have now entered human clinical trials.

• Soon clinical usefulness of these promising developments will be available for clinicians to adopt them in routine practice.
Thank You...!
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