PD Surgery: Graft Options in the Modern Day & Their Utility

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Incision/Partial Excision & Grafting - Indications

- Must have strong pre-op erections !!!
- Curvature > 60 degrees
- Significant shaft narrowing
- Hinge-effect present
- Extensive plaque calcification

N.B. – Plaque and deformity stable & coitus compromised 2° deformity

Ralph et al JSM 2010;7
Advantages of PIG/PEG Procedure

- Best opportunity to correct severe curvature > 60-70°
- Only approach to re-establish girth & correct hinge
- Least likely to cause further length loss
- Most likely to enhance length with or without traction post-op
Risks of PIG/PEG

- #1 thru 10 – Diminished rigidity to complete ED

- Others
  - Incomplete correction/recurrent curve – 5-10%
  - Shortening – rare
  - Diminished sexual sensation – temporary
Predictors of Risk of Post-op ED After Grafting

1) Age > 55y (n=56)\(^1\)
2) Curvature > 60\(^{°}\)\(^1\)
3) Pre-op venous leak\(^1\); RI < 0.80 (n=11)\(^2\)
4) Only parameter – pre-op EF status (n=37)\(^3\) (n=218)\(^4\)

\(^1\) Flores S et al. J Sex Med 2011; 8: 2031-7
\(^2\) Alphs H et al. J Sex Med 2010; 7: 1262-8
PD Grafts - History

- 1950 – Adipose tissue
- 1974 – Dermal autograft
- 1980 – Tunica vaginalis autograft
- 1980 – Dura mater allograft
- 1991 – Temporalis / Lata “Fascia” auto/allograft
- 1995 – Saphenous vein autograft
- 2000 – Tunica albuginea autograft
- 2000 – Tutoplast pericardium (human/bovine)
- 2005 – Buccal mucosa autograft
- 2007 – Porcine SIS
- 2002 – 2013 – Tachosil equine allograft

Garcia-Gomez et al, Androl, 2018, 6
Search for the Ideal Graft – Goes on!

- Availability
- Resists infection
- Does not contract
- Promotes hemostasis
- Preserves erectile function
- Cost-effective
- Various sizes available

*Successful grafting outcomes all about patient selection!*
### Results Achieved with Fascia Patches

<table>
<thead>
<tr>
<th>Type</th>
<th>Author/Year</th>
<th>N</th>
<th>Follow-up (months)</th>
<th>Success (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporalis</td>
<td>Gelbard &amp; Hayden (1991)</td>
<td>12</td>
<td>≥3</td>
<td>100</td>
</tr>
<tr>
<td>Lata</td>
<td>Kargi et al (2004)</td>
<td>12</td>
<td>10 (9-24)</td>
<td>100</td>
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<tr>
<td>Lata</td>
<td>Kalsi et al (2006) (Tutoplast)</td>
<td>14</td>
<td>31 (17-37)</td>
<td>78.6</td>
</tr>
</tbody>
</table>

Low # 10 – 31 mos 78 – 100%
# Results Achieved with Saphenous Vein Patches

<table>
<thead>
<tr>
<th>Author/year</th>
<th>N</th>
<th>Follow-up (months)</th>
<th>Success (%)</th>
<th>Shortening (%)</th>
<th>ED (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim &amp; McVary (1995)</td>
<td>6</td>
<td>31</td>
<td>83.3</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>El-Sakka et al. (1998)</td>
<td>112</td>
<td>≥18</td>
<td>96</td>
<td>17</td>
<td>12</td>
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<tr>
<td>Chalouhy et al. (1998)</td>
<td>18</td>
<td>N/A</td>
<td>90</td>
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<tr>
<td>Arena et al. (1999)</td>
<td>24</td>
<td>24</td>
<td>95.8</td>
<td>50</td>
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<tr>
<td>De Stefani et al. (2000)</td>
<td>8</td>
<td>13 (7–19)</td>
<td>87.5</td>
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<tr>
<td>Akkus et al. (2001)</td>
<td>50</td>
<td>32</td>
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<td>Yurkanin et al. (2001)</td>
<td>22</td>
<td>13.4</td>
<td>66.6</td>
<td>0</td>
<td>46</td>
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<tr>
<td>Adeniyi et al. (2002)</td>
<td>51</td>
<td>16</td>
<td>82</td>
<td>35</td>
<td>8</td>
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<tr>
<td>Metin et al. (2002)</td>
<td>18</td>
<td>17 (9–24)</td>
<td>88.8</td>
<td>16.6</td>
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<tr>
<td>Porena et al. (2002)</td>
<td>12</td>
<td>12</td>
<td>91.7</td>
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<tr>
<td>Montorsi et al. (2004)</td>
<td>50</td>
<td>≥60</td>
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<td>Kalsi et al. (2005)</td>
<td>113</td>
<td>12</td>
<td>86</td>
<td>25</td>
<td>15</td>
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<tr>
<td>Hsu et al. (2007)</td>
<td>48</td>
<td>N/A</td>
<td>90</td>
<td>N/A</td>
<td>5</td>
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<tr>
<td>Kadioglu et al. (2008)</td>
<td>70</td>
<td>41</td>
<td>75.7</td>
<td>&lt;0</td>
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<tr>
<td>Kim et al. (2008)</td>
<td>32</td>
<td>≥12</td>
<td>85</td>
<td>80</td>
<td>50</td>
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<td>Wimpissinger et al. (2016)</td>
<td>30</td>
<td>≥120</td>
<td>86.7</td>
<td>43.3</td>
<td>36.7</td>
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</table>

12-120 mos  66-96%  0-100%  0-50%
# Results Achieved with Buccal Mucosa Patches

<table>
<thead>
<tr>
<th>Author/year</th>
<th>N</th>
<th>Follow-up (months)</th>
<th>Success (%)</th>
<th>Shortening (%)</th>
<th>ED (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shioshvili &amp; Kakonashvili (2005)</td>
<td>26</td>
<td>38.4</td>
<td>92.3</td>
<td>15.4</td>
<td>7.7</td>
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<tr>
<td>Liu et al. (2009)</td>
<td>24</td>
<td>6–84</td>
<td>87.5</td>
<td>8.3</td>
<td>N/A</td>
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<tr>
<td>Cormio et al. (2009)</td>
<td>15</td>
<td>13.1</td>
<td>100</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Salem et al. (2014)</td>
<td>17</td>
<td>15</td>
<td>88.2</td>
<td>N/A</td>
<td>5.9</td>
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<tr>
<td>Zucchi et al. (2015)</td>
<td>28</td>
<td>≥12</td>
<td>96.4</td>
<td>N/A</td>
<td>3.6</td>
</tr>
<tr>
<td>Molina-Escudero et al. (2016)</td>
<td>10</td>
<td>22.7 (18–31)</td>
<td>100</td>
<td>80</td>
<td>10</td>
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</tbody>
</table>

Low # 12-84 mos 87-100% 0-80% 0-10%
# Results Achieved with Porcine Intestinal Submucosa Patches

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Author/year</th>
<th>N</th>
<th>Follow-up (months)</th>
<th>Success (%)</th>
<th>Shortening (%)</th>
<th>ED (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 layer</td>
<td>Breyer et al (2007)</td>
<td>19</td>
<td>15 (3-43)</td>
<td>63</td>
<td>63</td>
<td>53</td>
</tr>
<tr>
<td>4 layers</td>
<td>Knoll (2007)</td>
<td>162</td>
<td>38 (6-96)</td>
<td>92</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>4 layers</td>
<td>Lee et al (2008)</td>
<td>13</td>
<td>14 (3-89)</td>
<td>53.8</td>
<td>N/A</td>
<td>53.8</td>
</tr>
<tr>
<td>4 layers</td>
<td>Chung et al (2011)</td>
<td>17</td>
<td>75</td>
<td>76</td>
<td>29</td>
<td>63</td>
</tr>
<tr>
<td>4 layers</td>
<td>Cosentino et al (2016)</td>
<td>44</td>
<td>19 (11-48)</td>
<td>N/A</td>
<td>0</td>
<td>4.5</td>
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Low # x Knoll 9-38 mos 54-92% 0-63% 5-54%
# Results Achieved Using TachoSil®

<table>
<thead>
<tr>
<th>Author/year</th>
<th>N</th>
<th>Follow-up (months)</th>
<th>Success (%)</th>
<th>Shortening (%)</th>
<th>ED (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahme et al (2002)</td>
<td>19</td>
<td>25.3 (2-58)</td>
<td>83.3</td>
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<tr>
<td>Horstmann et al (2011)</td>
<td>43</td>
<td>63</td>
<td>83.7</td>
<td>93</td>
<td>21</td>
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<tr>
<td>Hatzichristodoulou et al (2013)</td>
<td>70</td>
<td>3.2 days</td>
<td>83.6</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Hatzichristodoulou et al (2016)</td>
<td>290</td>
<td>36.8 (3-100)</td>
<td>97.5</td>
<td>0</td>
<td>10.7</td>
</tr>
</tbody>
</table>

Days – 37 mos: 83-97% 0-93% 0-21%
## Results Achieved with Bovine and Human Pericardium Patches

<table>
<thead>
<tr>
<th>Material</th>
<th>Author/year</th>
<th>N</th>
<th>Follow-up (months)</th>
<th>Success (%)</th>
<th>Shortening (%)</th>
<th>ED (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>Chun et al (2001)</td>
<td>9</td>
<td>8 (1-8)</td>
<td>55.6</td>
<td>N/A</td>
<td>55.6</td>
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<tr>
<td>Human</td>
<td>Leungwattanakij et al (2001)</td>
<td>8</td>
<td>30 (25-35)</td>
<td>87.5</td>
<td>N/A</td>
<td>62.5</td>
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<tr>
<td>Bovine</td>
<td>Egydio et al (2002)</td>
<td>33</td>
<td>19.4 (5-30)</td>
<td>87.9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Human</td>
<td>Levine &amp; Estrada (2003)</td>
<td>40</td>
<td>22 (2-40)</td>
<td>98</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>Human</td>
<td>Taylor &amp; Levine (2008)</td>
<td>81</td>
<td>58 (6-185)</td>
<td>91</td>
<td>33</td>
<td>32</td>
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<tr>
<td>Human</td>
<td>Flores et al (2011)</td>
<td>52</td>
<td>6</td>
<td>100</td>
<td>0</td>
<td>46</td>
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<tr>
<td>Bovine</td>
<td>Sansalone et al (2011)</td>
<td>157</td>
<td>20 (12-24)</td>
<td>88</td>
<td>0</td>
<td>29</td>
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<tr>
<td>Bovine</td>
<td>Otero et al (2016)</td>
<td>41</td>
<td>14 (8-20)</td>
<td>80.5</td>
<td>0</td>
<td>24.4</td>
</tr>
</tbody>
</table>

*Follow-up range: 6-58 mos  
Success range: 55-100%  
Shortening range: 0-33%  
ED range: 0-62%
Interpreting Results – Graft Studies

- **Follow-up time** – varies widely – How long to know when stable?
- **Pre-op assessment** – varies wrt EF, deformity – must be objective! (curve/indent), length, calc – best w/ duplex U/S
- **Curvature correction** – must define “straight”
  - Reported <5° to 30°
  - “functionally straight” <20°
  - Usually reported subjectively

Garcia-Gomez et al, Androl, 2018, 6
Interpreting Results – Graft Studies continued

- **Post-op erectile function – when to eval? Min 12 mos**
  - Rarely objective – no validated questionnaire for PD
  - Ultimately pt reports +/- penetration

- **Patient #**
  - Most studies low # – Is there a minimum # for adequate power?

- **Patient satisfaction – Subjective +/- bias**
  - Yes/No
  - Likert 0-10
  - Would you do again?

- **Overall sat wrt**
  - Deformity, rigidity, sensation, length, nodules, ability to have sex

Garcia-Gomez et al, Androl, 2018, 6
Specific Grafts – Thoughts

- **Synthetic patches** – rejected 2° fibrosis & risk of infection
- **Dura mater** – abandoned 2° ↑ risk viral transmission
- **Dermis** – discarded 2nd incision & ? ↑ risk CVOD
- **Tunica albuginea** – ‘perfect’ substitute but 2nd incision, ? adequate volume & Long-term sequelae
- **Saphenous vein** – limited use, 2nd incision, ? adequate volume
Specific Grafts – Thoughts continued

- **Tachosil** – sutureless clearly a plus, but difficult to determine residual curve, costly, very limited long-term outcome data (1° single surgeon), *ideal over IPP*

- **SIS** – must be sutured, ↑↑ risk of contraction, costly

- **Buccal mucosa** – limited reports, 2\textsuperscript{nd} incision, ? long-term outcome & ? adequate volume
Tutoplast – My Preferred Graft

- Many published reports, most with satisfactory f/u
- **Process** – Osmotic diffusion, Acetone & Sodium hydroxide bath, Gamma radiation, Freeze-dried (4x7,6x6 cm) – rids organic material, virus, prions – leaves protein matrix for TA ingrowth over 12-18 mos
- Over 2 million cases – no transfer of dz
- Strong, yet thin, easily sutured, **minimal contraction**, no rejection, low infection rate
- Outcomes – always related to patient selection w/ all grafts!!
PD – Surgical Algorithm
(Levine and Dimitriou 2000)

- When inadequate rigidity +/- PDE5i’s
  3) Penile Prosthesis Placement
    - IPP alone (not LGX)
    - With modeling (Wilson)
    - With incision
    - With incision and grafting (defect >2 cm)
- Plication b/4 IPP placement

Morey et al JSM 2013
Comparison of Hemostatic Patches vs. Human Pericardium for Treatment of Complex PD w/ IPP & Grafting

- M&M – 33 men w/ PD & ED who underwent PIG w/ IPP
  - 18 had HP (Evarrest-10, NuKnit-6, TachoSil-2 vs 15 Tutoplast PG)

- Results: No difference in age, pre-op curve (75° v 78°) or grafted area. **Op time shorter for HP (122 v 166 min p=0.1)** Residual curve >20° for HP 16.7% (N=3) v PG 13.3% (N=2) No complications ass w/ patches, 94% were engaged in penetrative sex post-op

- Concl: HP are effective materials to cover tunical defects following grafting with shorter operative time v PG

Farrell et al, Urol 129, 2019
PD Grafting – Conclusions

- Follow surgical algorithm
  - Must have strong pre-op erections
  - Must understand risk of post-op ED
  - Be aware that 2/3 PEGs will need add’l plication
  - Define patient goals pre-op wrt
    - Straightness – “arrow v functionally”

- Further outcomes research w/ defined criteria needed wrt deformity, recurrence, sensation, length & rigidity

- Choice of graft – Still open
  - Surgeon preference rules!