The Plasticity of Titanium in Orthopedics

ROBIN YOUNG

ORTHOPEDICS THIS WEEK
Robin Young

**Education**
1971-1978

- Adjunct Professor of Finance: Carlson School of Management
- Masters in Business Administration
- University of Minnesota
- Bachelors of Science: Legal Administration

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**WALL STREET**
1978 - 2005

- HealthpointCapital
  - Founding Partner
- Stephens Inc.
  - Managing Director
  - Senior Vice President
  - Life Science Research
- PiperJaffray
  - Vice-President Equity Research
- Craig Hallum
  - Jr. Equity Analyst
- The Wall Street Journal
  - Ranked: Top Ten Analysts in the United States

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**RRY Publishing and PearlDiver**
2005-present

- Orthopedics
  - 186,000 Orthopedic Readers each Month
  - Winner of AAOS Award for Journalistic Excellence - 4X Growing 30% annually
- PearlDiver
  - 5 billion patient records
  - 10 Years of longitudinal data
  - Powered for clinical study simulations
  - Used by academic researchers and cited in more than two dozen peer reviewed journals
A Brief History of Orthopedics

DAWN OF THE AGE OF SURGERY
John Chamley – father of modern orthopedics
War and orthopedics

External Fixation Dominated pre-1950s
The Kirchner Nail

Küntscher nail was first described in the US in a March 12, 1945, Time Magazine article, entitled “Amazing Thighbone.”
300 failures in a row
Once orthopedists got over their fear of surgery, the practice of implanting metal and polymer constructs exploded.

1963:
Small scale production of Charnley Hip Begins

2000:
400,000 large joint implant surgeries annually

2016:
800,000 surgeries
7 million implant patients WALKING around
Treating Musculoskeletal Diseases and Trauma - The last 5 Years

Between 2011 and 2015 Orthopedic Procedure Volumes rose 21% and surgeon incomes rose 18% and prices fell 11%. Highlights and lowlights:

- Affordable Care Act became law and...
  - 11 million more patients received insurance
  - The big Insurance companies began to merge into an oligopoly
- Centers for Medicare and Medicaid Services launched programs for bundling payments and rewarding or punishing hospitals
- Commoditization of implants and instruments became a reality and there was a notable decline in implant and instrument innovation
- Surgeon product champions became an endangered species and the surgeon-employee became the norm.
2011- 2015
Orthopedic Surgical volumes, pricing and sales

- Surgical volumes $+21.9\%$
- Pricing $(11.5\%)$
- Manufacturer sales $+10.6\%$
An Explosion of Mergers

Suppliers
- 6 orthopedic suppliers have made 37 acquisitions in the last 5 years
- The major purchases were:
  - DePuy acquires Synthes
  - Zimmer acquires Biomet
  - Stryker acquires MAKO
  - Smith & Nephew acquires ArthroCare
  - Zimmer acquires LDR
  - Smith & Nephew buys Blue Belt
- One purchase that did NOT happen: Stryker did not buy Smith & Nephew

Insurance Carriers
- Anthem to buy Cigna
- Aetna to buy Humana
- United Health Bought Catamaran
- Centene Bought Health Net
50% increase in arthritis diagnosis between 2012 and 2040

- From 2010-2012, an estimated 52.5 million US adults (22.7%) annually were told by a doctor that they have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia.\(^3\)
- An estimated 49.7% of adults 65 years or older reported doctor-diagnosed arthritis from 2010-2012.\(^3\)
- An estimated 62% of adults with arthritis are <65 years old.
- By 2040, an estimated 78 million Americans ages 18 years or older are projected to have doctor-diagnosed arthritis.\(^4\)
- An estimated 294,000 children under age 18 have some form of arthritis or rheumatic condition; this represents approximately 1 in every 250 children in the United States.\(^5\)
People are living and working longer

- The number of Americans ages 65 and older is projected to more than double from 46 million today to over 98 million by 2060, and the 65-and-older age group’s share of the total population will rise to nearly 24 percent from 15 percent.

- The older population is becoming more racially and ethnically diverse. Between 2014 and 2060 the share of the older population that is non-Hispanic white is projected to drop by 24 percentage points, from 78.3 percent to 54.6 percent.

- Older adults are working longer. By 2014, 23 percent of men and about 15 percent of women ages 65 and older were in the labor force, and these levels are projected to rise further by 2022, to 27 percent for men and 20 percent for women.
Shifting Technological Emphasis

Robotics
- Stryker
- Medtronic
- Smith & Nephew
- Zimmer Biomet
- Globus Medical
  - Reduce errors
  - Increase throughput
  - Reduce the labor intensive nature of surgery

3D Printing
- Explosion of innovation in implants
- Titanium #1 preferred material for 3D printed implants
- EVERY implant manufacturer will shift to 3D Titanium Printing

Predictive Analytics
- Reduced surgeon autonomy
- Computers will increasingly direct treatment decisions
- Automatic pilot in the clinic, hospital and ambulatory clinic setting
PEEK Implants – Spine, Trauma, Sports Medicine

Finished PEEK implant design (left) was infiltrated with a bioresorbable polymer/ceramic hybrid material (right), shown in an earlier model without chips for promoting bone growth.
FTC Slams Invibio’s PEEK Implant Business Practices. Alleges Monopolistic Practices
Titanium - long standard for metal implants in Orthopedics - not sexy???
Increasingly, PEEK implants, which are invisible to X-Rays, are being coated with Titanium. Better visibility, durability and integration at the bone interface. Lysophosphatidic acid (LPA).
Mixture of 

\textbf{titanium and gold} turns out to be the \textbf{hardest known metallic substance} that is compatible with living tissues.
3D Printing unlocking an EXPLOSION of implant innovation
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<th>Ortho companies who are looking at adding 3D Titanium printing</th>
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<td>Advanced Biologics</td>
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<td>Aesculap Inc</td>
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<td>Allen Medical</td>
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<td>AlloSource</td>
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<td>Alphatec Spine, Inc.</td>
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<td>Amedica</td>
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<td>Aptic Superbones</td>
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<td>Arthrex</td>
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<td>ArthroCare Corporation</td>
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<td>Aspen medical Products</td>
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<td>Atlas Spine Inc</td>
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<td>Auxilium Pharmaceuticals, Inc</td>
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<td>Aurora Spine</td>
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<td>ConforMIS, Inc</td>
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<td>Custom Spine</td>
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<td>DePuy Spine</td>
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<td>DePuyPharm, Inc(Baxter)</td>
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<td>DJO LLC</td>
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<td>DSM Medical</td>
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<td>ECI Biotech, Inc</td>
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<td>Eden Spine LLC</td>
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<td>Globus Medical Inc</td>
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Conclusion

- Orthopedics, the largest sector in medicine, is in the middle of a baby boomer aging, increased insurance coverage, obesity driven rising demand curve.

- Orthopedic implants and bracing is a long term growth market based on rising numbers of hip, knee, spine, shoulder, elbow, wrist, hand, foot and ankle procedures over the next 30-40 years.

- The industry is consolidating and costs are coming down.

- Innovation is focused on doing more with less.

- 3D printing with titanium creates longer lasting, more user friendly implants with much less material.

- Titanium suppliers will the MAIN beneficiaries of this technological change

- Suppliers need to help orthopedic companies make the transition to 3D printing
Thank you
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