Titanium alloys in the Metals & Processes for the orthopaedic global market
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Global orthopaedic market (by segment, actors, outlook)

Components : in house & contract manufacture (by segment, processes, actors, strategy)
Focus : Metallic Raw materials
Trends & market outlook

A proprietary contract manufacturing: the case of cannulated bars.

Orthomaterials working group.
Worldwide Orthopaedic market (2014):
37.4 B. US$

- Spinal: 8.0 B. US$ (+2.5%)
- Knee: 8.5 B. US$ (+5.1%)
- Hip: 6.4 B. US$ (+2.9%)

- Extremities: Shoulder, Elbow, Ankle, Foot, hand, ... (excluding trauma)
- Orthobiologics: Allograft, Xenograft, Synthetic Bone, Cement, BMP, others, Cell based Product, Auto repair product, Anti Adhesion product, Hyaluronic Acid, ...
Demographics 1950-2050 and population over 65

Demographics and market drivers

Growing Obesity
% in %

Health expenses
% from GNP

Source: OCDE
Forecast Global Orthopaedics

Growth 2014 – 2020 (9.3% up to 2015, then +6.2%)

CAGR = Compound Annual Growth Rate


CAGR 2014-2020:
ORTHOBIO.: +7.2%
TRAUMA: +6%
SPINE: +7.7%
EXTREMITIES: +11%
KNEE: +6%
HIP: +3.9%
Worldwide orthopaedic market in 2014: competition

2014 Worldwide Orthopaedic Market

- Depuy-Synthes: 21%
- Stryker: 13%
- Medtronic: 8%
- Zimmer: 11%
- Smith & Nephew: 6%
- Biomet: 6%
- Other: 35%

2014 revenues of the Major Orthopaedic Companies (B$)

- Depuy-Synthes: 7.9 B$
- Stryker: 4.9 B$
- Medtronic: 6.1 B$
- Zimmer-Biomet: 6.3 B$
- Smith & Nephew: 3.0 B$

2012: Depuy acquired Synthes for 21.3 BUSD

Zimmer to acquire Biomet for 13.4 BUSD

Source: Avicenne research & analysis 2015
Forging 2014: Home-made & Contract Manufacturing

Contract Manufacturing
402 M US$

Home-made
75 M US$

Source: Avicenne 2015
Hip machining & finishing: in & out source

Contract Manufacturing
152 M US$

Home-made
236 M US$

Source: Avicenne 2015

Depuy-Synthes & challengers make more outsourcing than home-made. Liners & heads are often made in-house.
Spine & trauma machining & finishing: in & out source

Home-made: 1 356 M US$

Spine & Trauma machining & finishing plates, screws, cages, hooks, ... are the first orthopaedic component supplying in value! Medtronic & Depuy-Synthes make the main part in house.

Contract Manufacturing

891 M US$

Source: Avicenne 2015
Supplychain

Contract Manufacturing
- Implants
- Instruments
- Cases & Trays

(OEM)
Sales in 2014:
37.4 B. US$

5 Major
Minor 10
100 followers

Hospitals & Clinics

Employers:
- TECOMET
- ORCHID

OEMs:
- DePuy Synthes
- Stryker
- Smith & Nephew
- Medtronic
- ZIMMER BIOMET

Brands:
- Availign
- Paragon Medical
- Greatbatch
- Norwood Medical
- Marc
- NUVASIVE
- Tegra
- NuVasive
- Mathys
- Lima
- Wright

Worldwide contract manufacturing 2014
(in Mio. US$)

Top 15 made < 40% of the ortho Contract Manufact. market
Contract Manufacturing competitor ranking & dispersion

- Top 16: 1800 M US$ Average: 114 M US$
- Top 17-100: 600 M US$ Average: 7 M US$
- From 101 to >1000: 1700 M US$ Average < 2 M US$

Source: Avicenne 2015
Contract Manufacturing market historical revenues & forecasts (M US$)

Implants will grow more rapidly than the instruments & cases & trays.

Source: Avicenne research & analysis 2013
Summary

- **Facts:** 3.6 B US$ in-house and 4.1 B US$ by contract manufacturers
- **Segments:** trauma, spinal & forgings accounts for 60% plus.

- **Headwinds:** OEMs are requiring their Contract Manufacturers to reduce costs and sometimes follow them in certain low cost country. Regulatory. Process change controls. Certification bodies.

- **Tailwinds:** Contract manufacturing benefits from the main drivers: population, wealth, obesity, product mix evolution, shift in outsourcing rate and implant facility divestments. Consolidation potential. One stop shop.
- Contract manufacturing by 2018 will grow more than home made, at a robust 5.5%.
- Implant will grow more rapidly than any other segment.
Surgical Technique: MIS
Key words: trauma, fracture fixation, K-Wire, positioning
Plants: Extrusion- Rolling & Drawing
Production Flow Chart

Material inventory

Insertion of mandrel in the hole

Insert / core

Hot extrusion

Material control & testing
To ASTM & ISO

Cutting of billets

Boring of the hole

Semi-finished extrusions

F \text{max} \approx 1310 \text{T}