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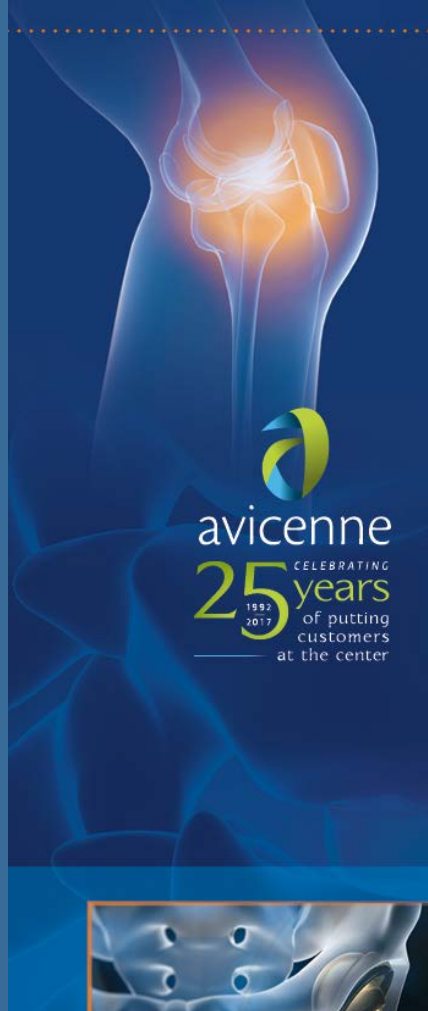


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TITANIUM EUROPE 2019

VIENNA, AUSTRIA MAY 15



TITANIUM
EUROPE 2019

MAY 13-15 • VIENNA, AUSTRIA



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Worldwide
Orthopaedic Market &
Contract
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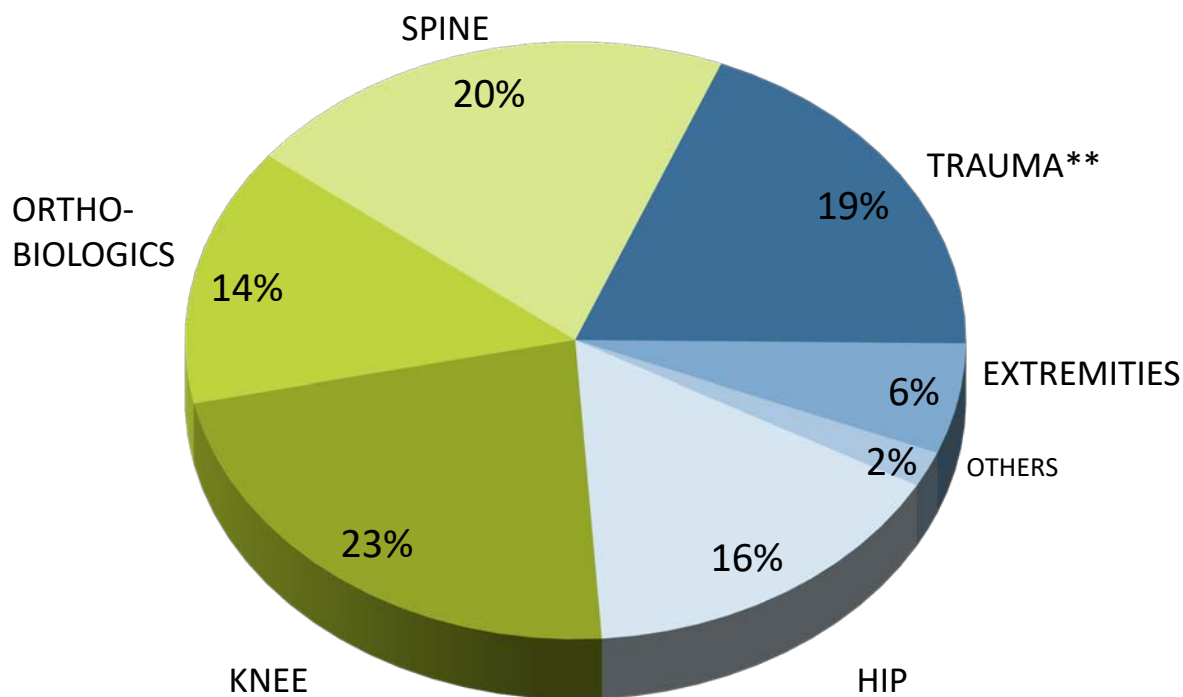
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Worldwide orthopaedic* markets in 2018:

44 BUS\$ (+4% vs 2017)



KNEE
10 BUS\$
+3.6%

SPINE
9 BUS\$
+2.8%

TRAUMA
8.4 BUS\$
+4.9%

Hip
7 BUS\$
+2.2%

Source: Avicenne research & analysis 2019

- * Not included: Power tools, Arthroscopy & soft tissue repair, sport Medicine, Neuro-stimulation
- ** Trauma includes CMF
- 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,...
- Other: Navigation, ortho. equipment, etc..

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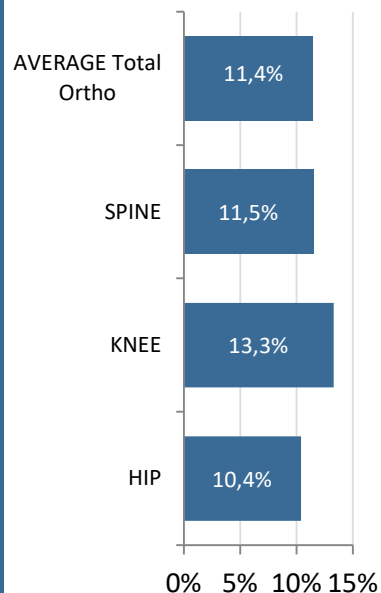
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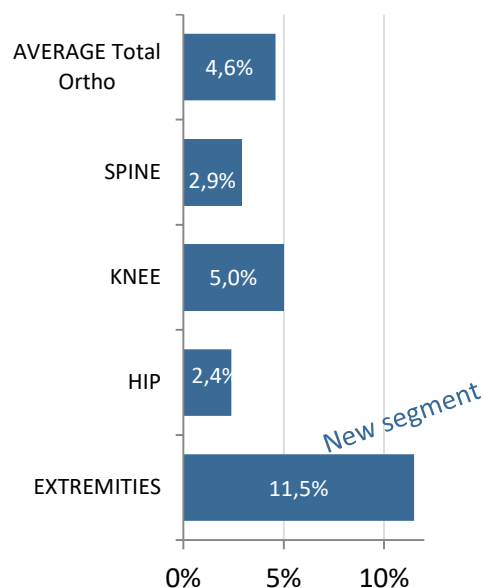
Worldwide orthopaedic market growth

Double digit growth of the years 2000-2010 is gone for the main segments (Spine, Knee, Hip), healthy single digit growth is still observed, with some niche market segments still enjoying high growth, as well as some newly created markets like extremities.

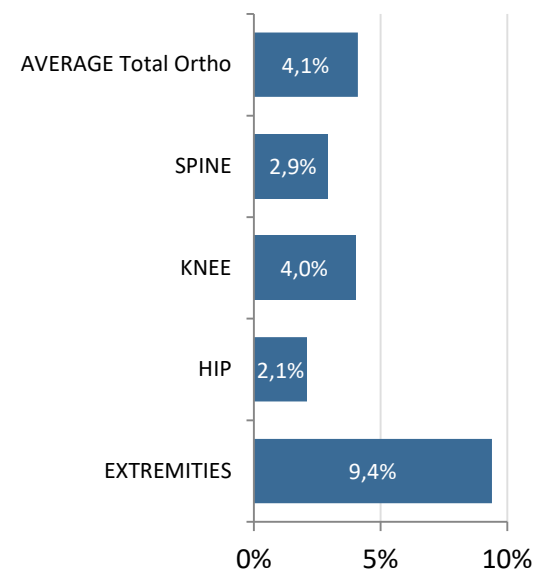
2000 - 2010 CAGR



2010 - 2015 CAGR



2015 - 2018 CAGR



Source: Avicenne research & analysis 2019

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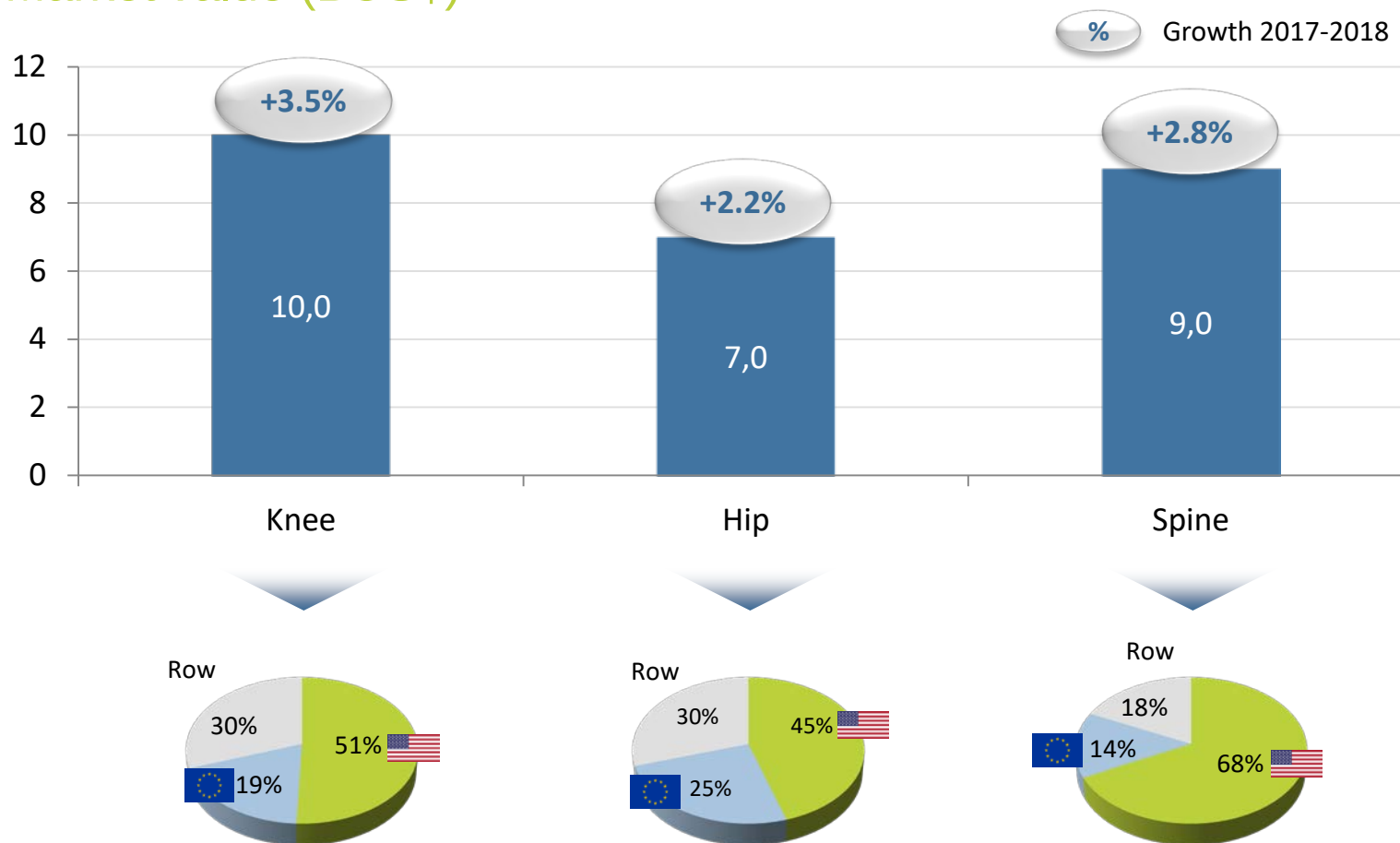
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Worldwide implants market in 2018 in value (BUS\$)

Market value (BUS\$)



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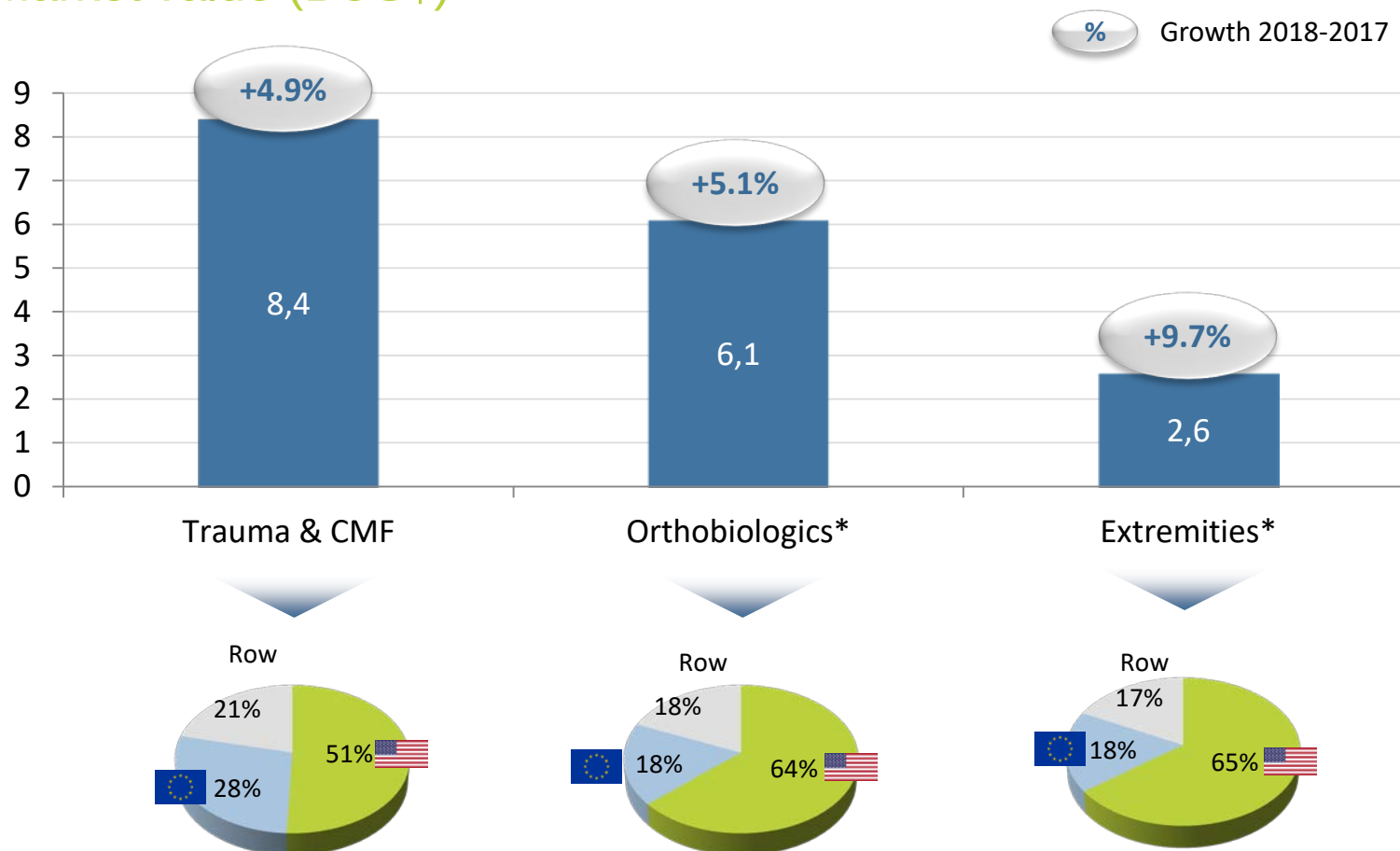
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Source: Avicenne research & analysis 2019

Worldwide implants & Orthobiologics market in 2018 in value (BUS\$)

Market value (BUS\$)



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*Extremities: Shoulder, Elbow, Ankle, Foot, hand,... (excluding trauma)

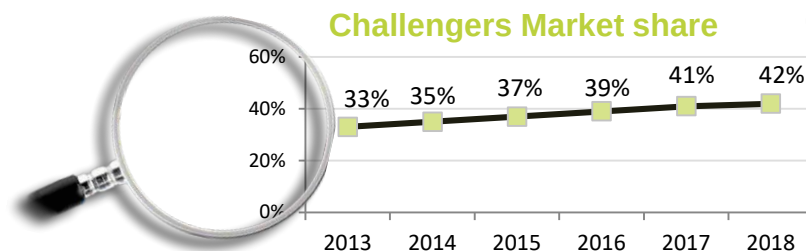
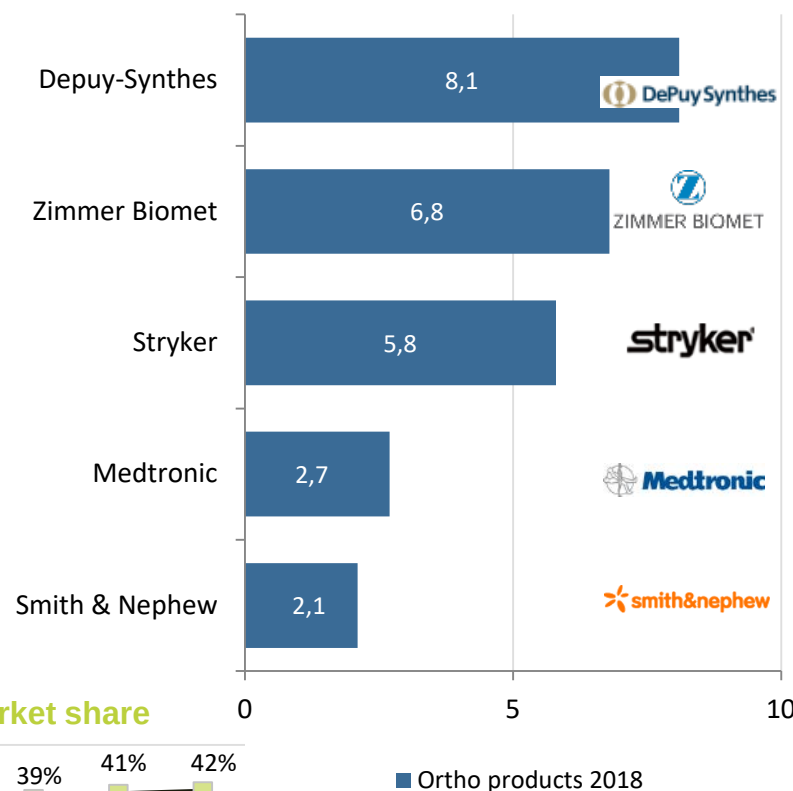
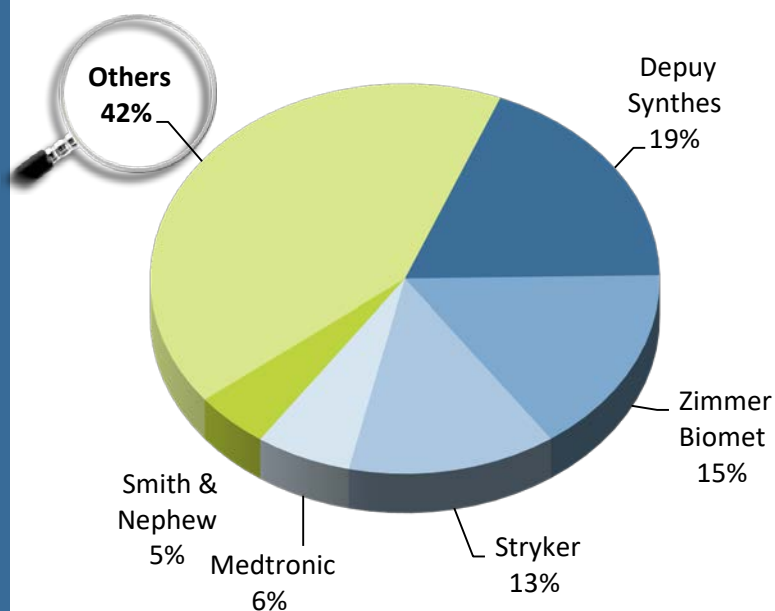
**Orthobiologics: Allograft, Xenograft, Synthetic Bone, Cement, BMP, others, Cell based Product, Auto repair product, Anti Adhesion product, Hyaluronic Acid,...

Source: Avicenne research & analysis 2019

Worldwide orthopaedic market in 2018: competition

2018 Worldwide Orthopaedic Market: 44 BUS\$

2018 revenues for Majors ~25 BUS\$



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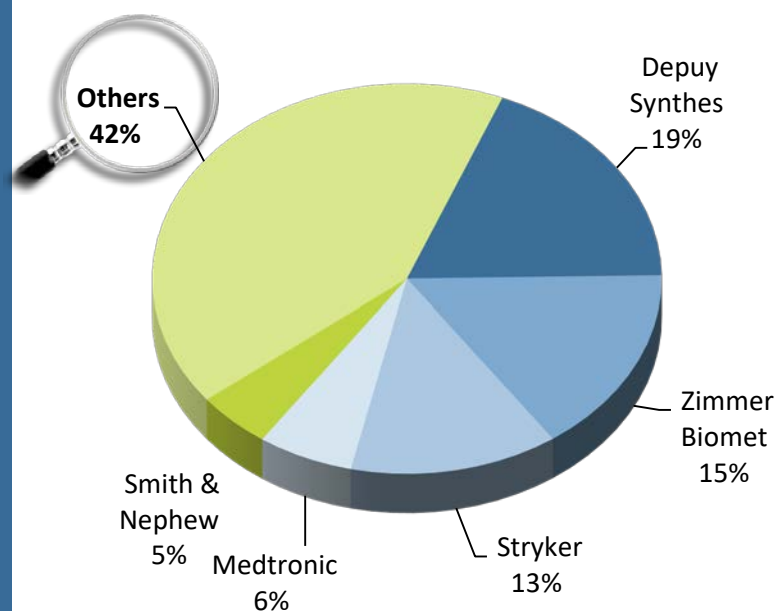
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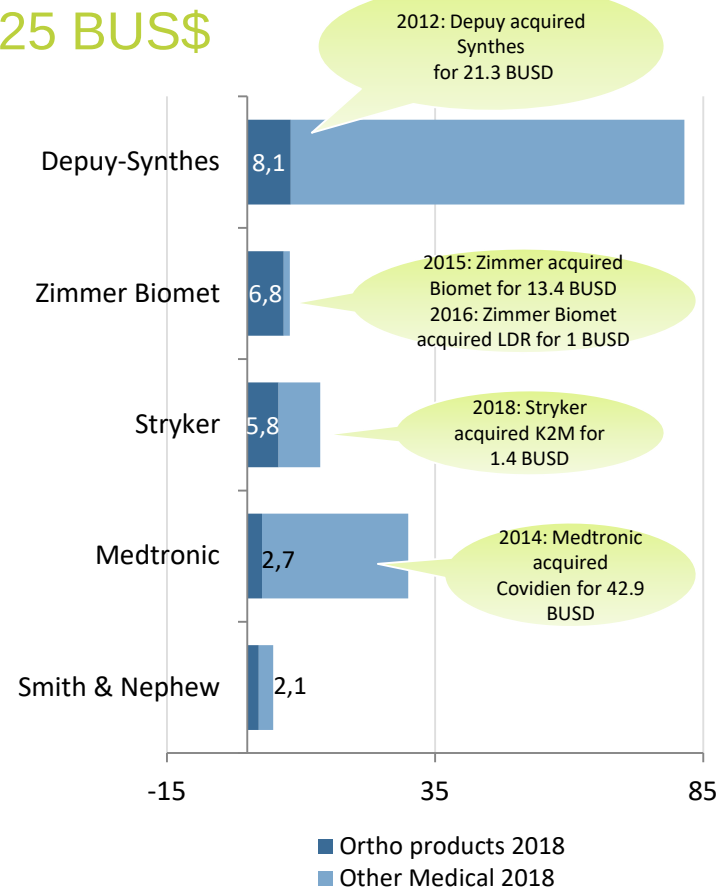
Source: Avicenne research & analysis 2019

Worldwide orthopaedic market in 2018: competition (2/2)

2018 Worldwide Orthopaedic
Market: 44 BUS\$



2018 revenues for Majors
~25 BUS\$



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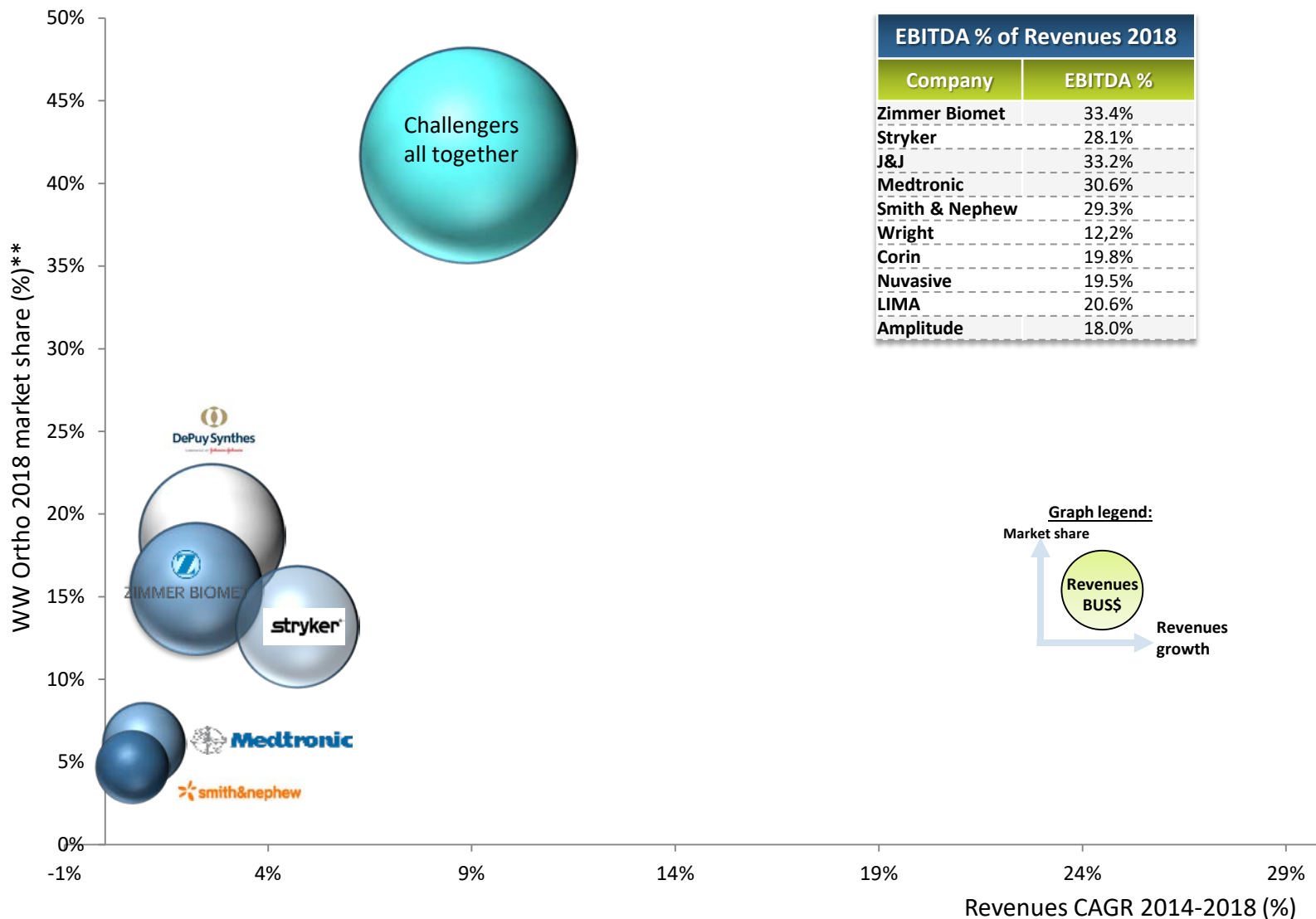
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Source: Avicenne research & analysis 2019

Majors vs. Challengers: Majors saved their margins while Challengers got the growth!



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- export: apart from their home country
- ** Excluding orthobiologics

Source: Source: Avicenne, annual reports and companies 2019

Worldwide orthopaedic market forecasts

Worldwide orthopaedic market: CAGR 2018-2023 +4 %

Orthopaedics market Drivers in 2000-2010 :

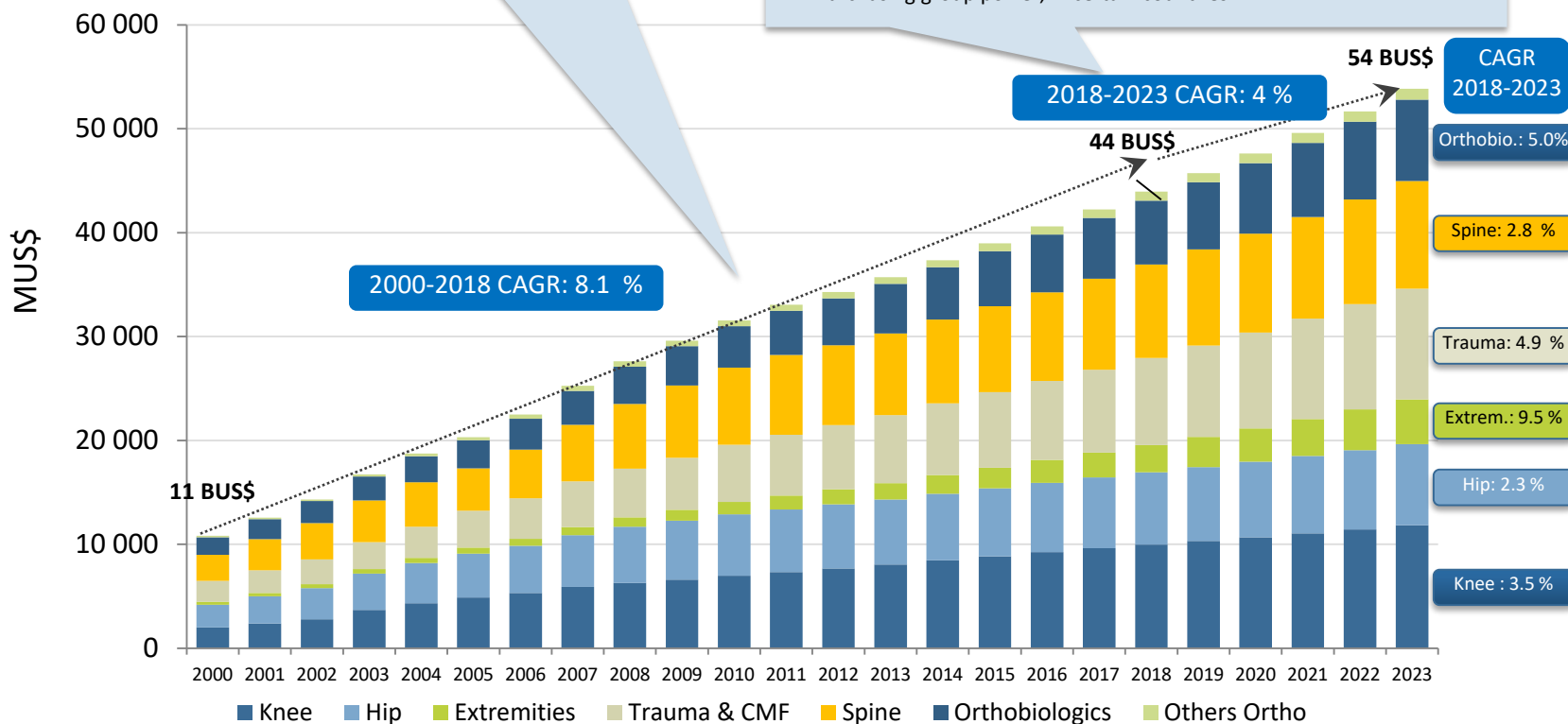
- Huge growth in hip & knee in developed countries
- USA : No price erosion, Europe slow price erosion
- Huge growth in spine procedures

Orthopaedics market Drivers: 2018-2023

- High growth in volume in emerging countries
- Orthobiologics & knee growth in developed countries
- Extremities become multi Billion market with almost double-digit growth
- Trauma with historical constant growth
- Niche segments with high growth: vertebral disks, etc.

Orthopaedics market limiters: 2018-2023

- Price pressure at the end-market level
- Continuous regulatory cost increase
- Purchasing group power, in certain countries



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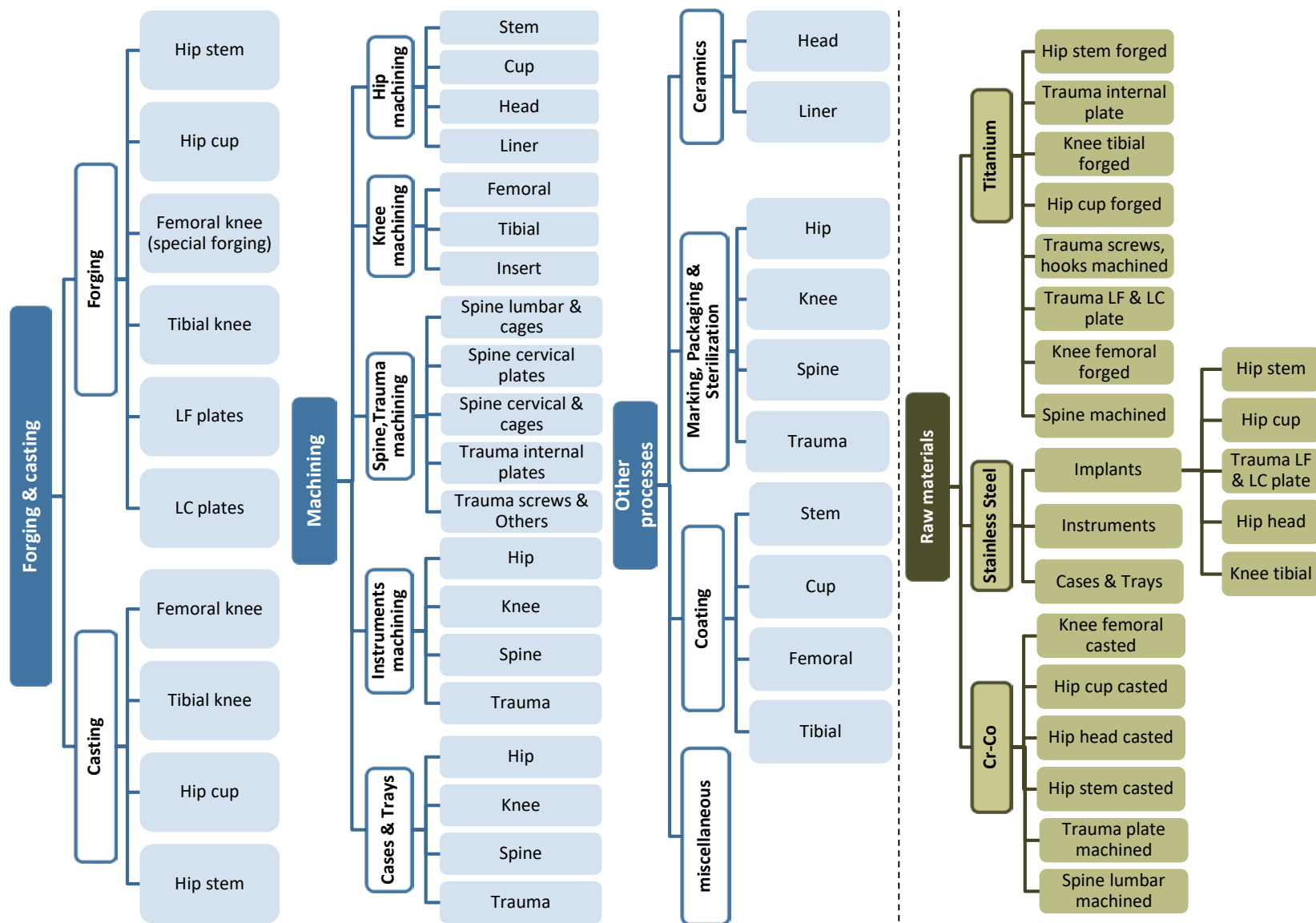
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Source: Avicenne analysis 2019

Contract Manufacturing processes segmentation & Raw materials: 14 segments & 62 sub-segments



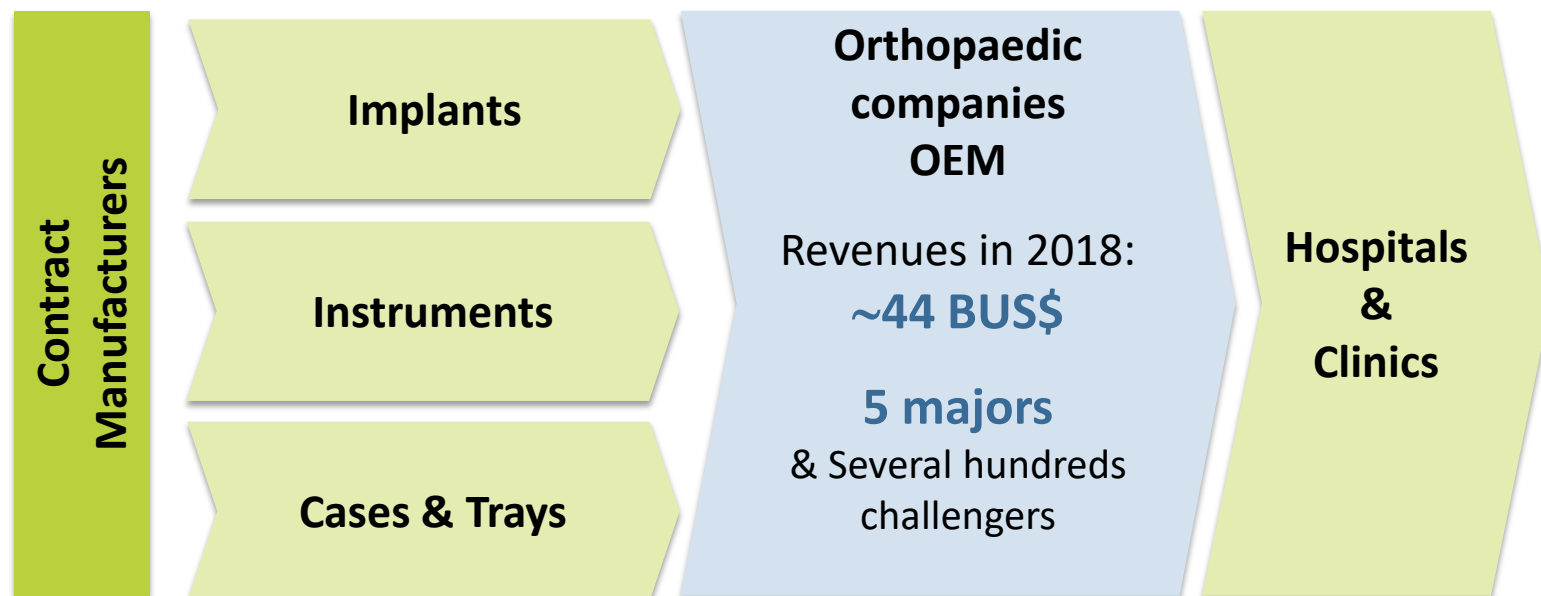
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Contract Manufacturing market value chain: Major OEMs have a different outsourcing strategy Vs Challengers.
Challengers outsource almost all their products.



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OEM Contract Manufacturing strategy: Zimmer Biomet

Only Major still with significant forging capabilities



Casting: In-House → Warsaw (USA)

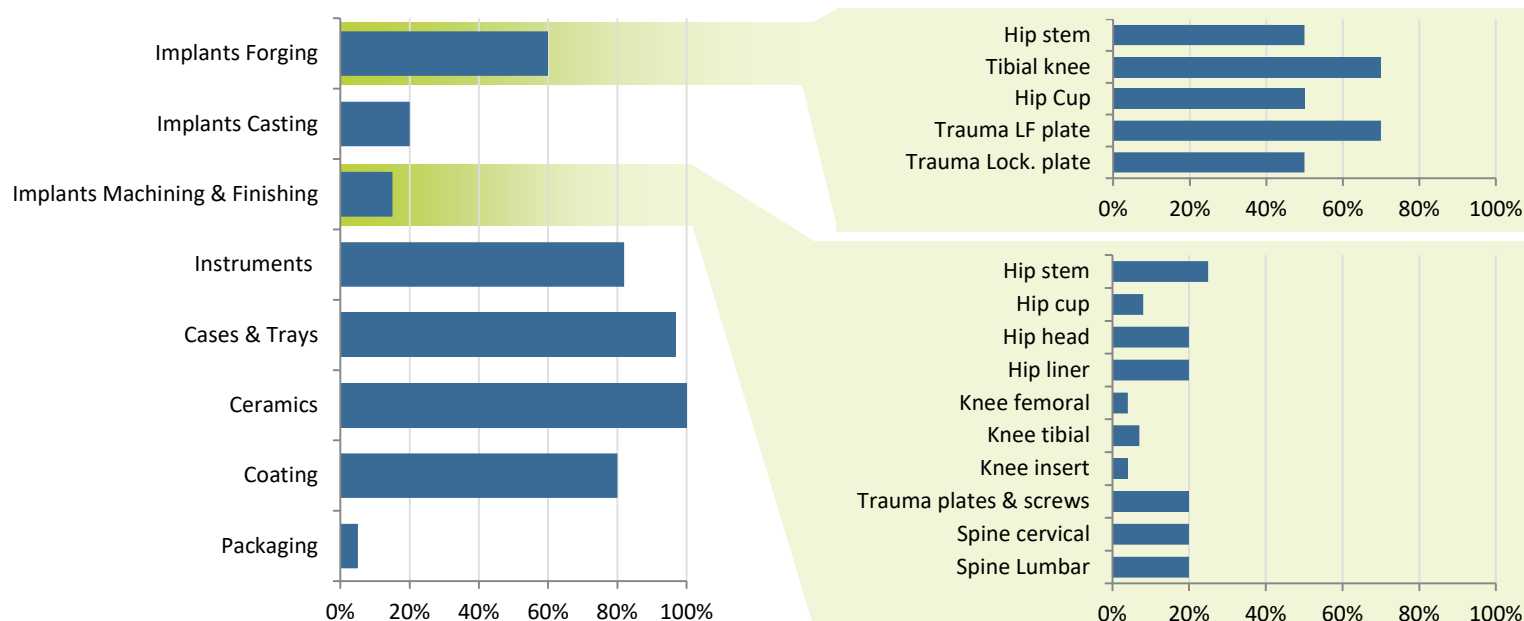


Forging: Winterthur (CH) – Berlin (Gr)



Machining & other facilities: Warsaw, Dover, Parsippany, Jacksonville, Palm Beach Gardens, Austin (USA) - Winterthur (CH) – Berlin (Gr) - Bridgend (UK) – Shannon, Galway (Ir) - Valence (Fr) - Valencia (Spain) - Ponce (Puerto Rico) - Beijing, Jinhua, Changzhou (China)

Contract Manufacturing Rate



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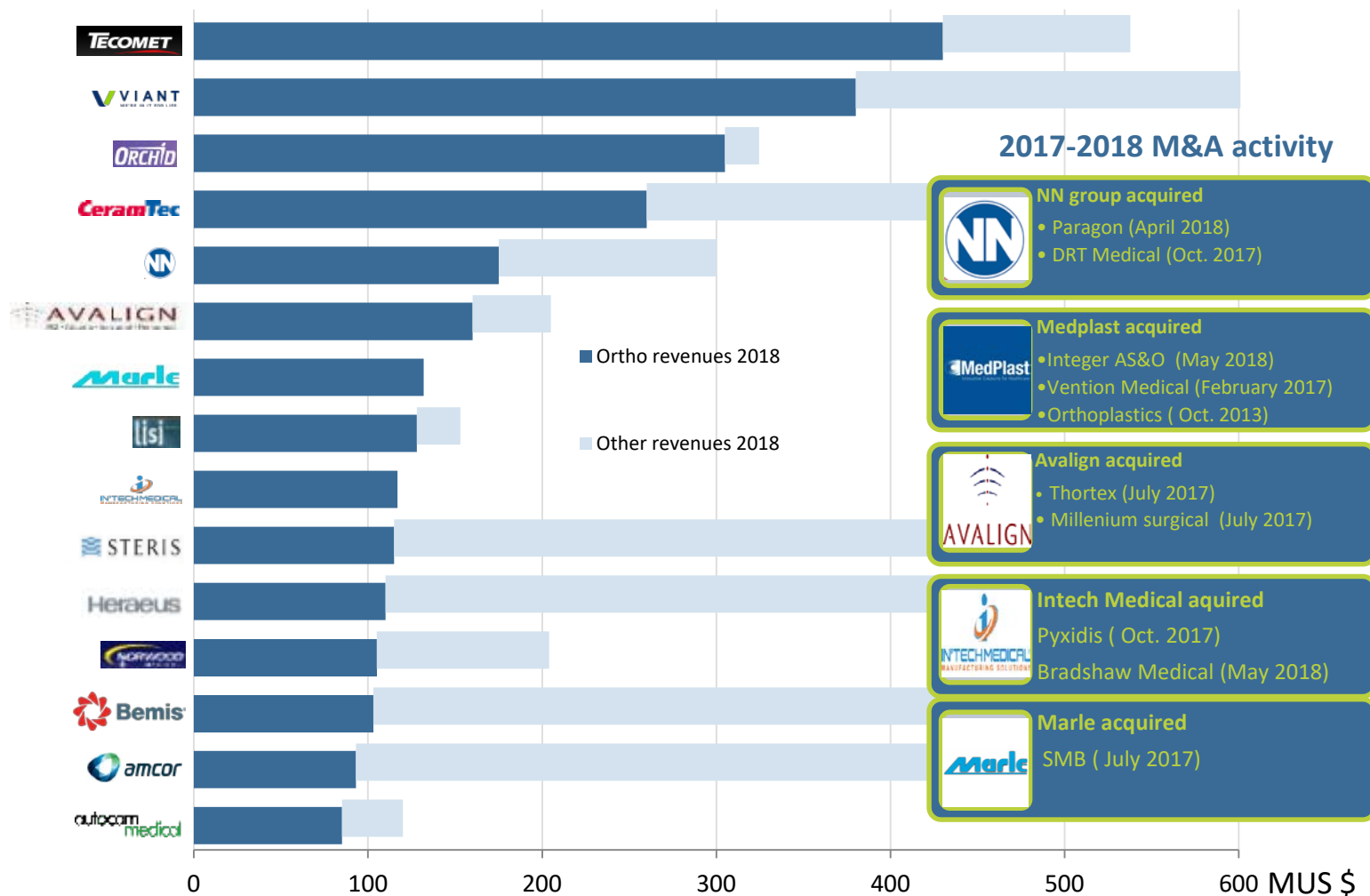
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Source: Avicenne 2019

Orthopaedic Contract Manufacturers offering full range of products (Implants, Instruments, Cases & Trays) in 2018

New players are entering the market: Medplast, now VIANT, with Integer acquisition will make 380 MUS\$ in Orthopaedic and Spine. NN Inc. with Paragon acquisition will reach 175 MUS\$ revenues in Orthopaedic and Spine in 2018 (+100 MUS\$ other medical). Avalign will make 160 MUS\$, In'Tech medical will reach close to 120 MUS\$.



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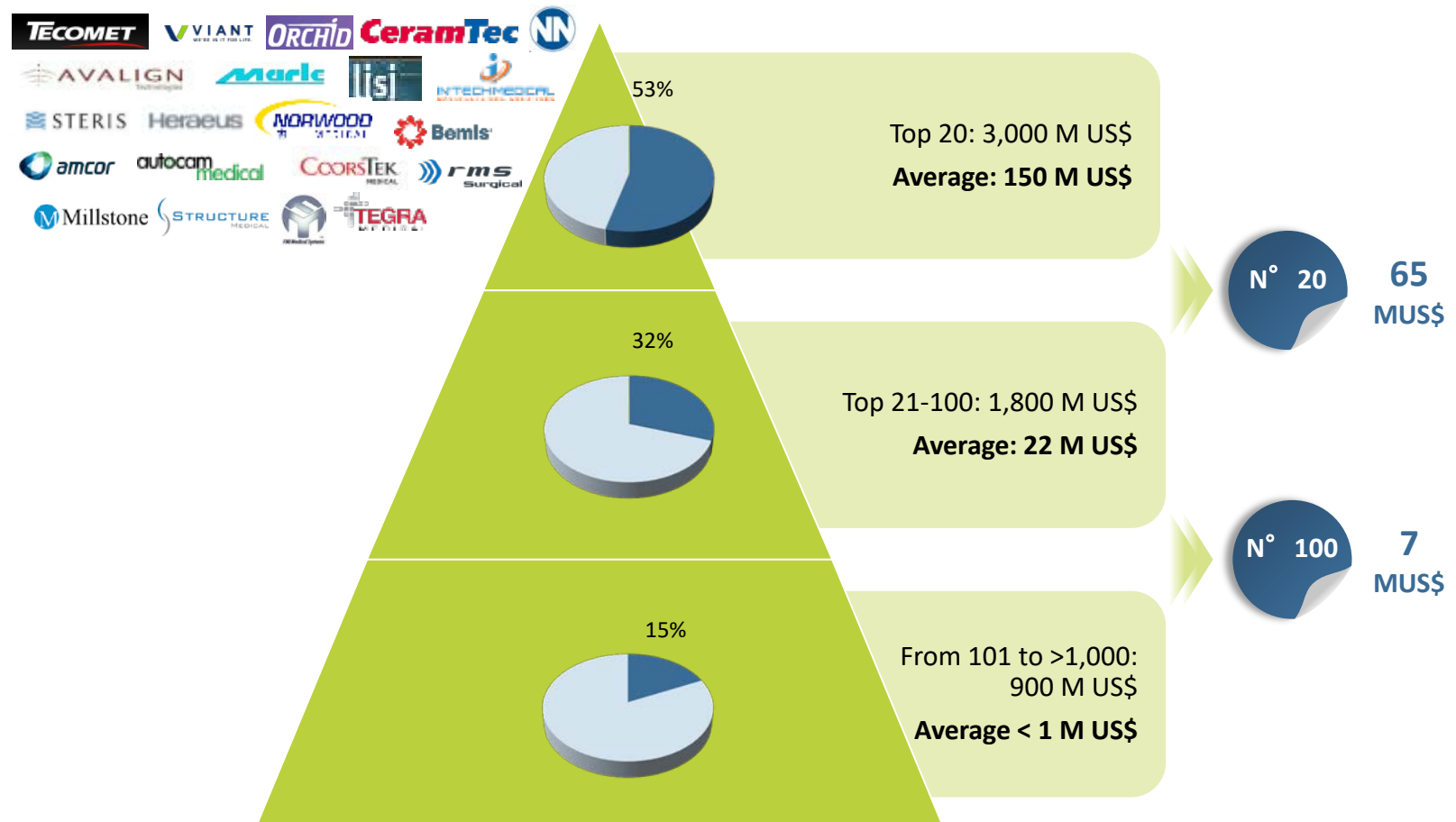
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Contract Manufacturing competitors' ranking & dispersion

While OEM industry is very concentrated (Top 5, 58%), CMO industry is still fairly fragmented (Top 5, 27%).



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Contract Manufacturing industry still needs more concentration

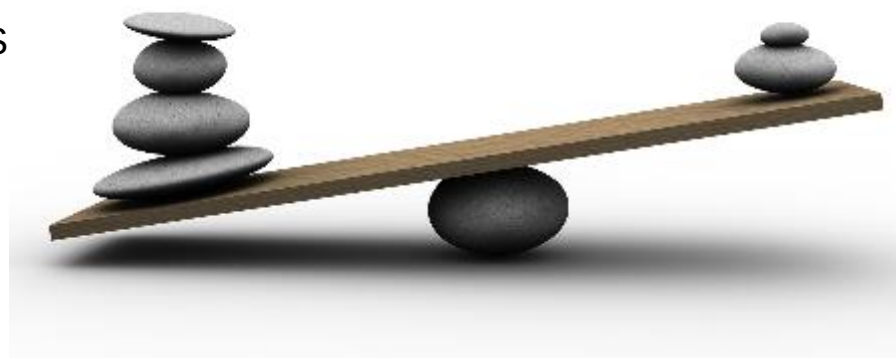
The comparison between COGS (Cost of Goods Sold) spending of ~5,8 BUS\$ from Majors and Top 20 CMO revenues of 3 BUS\$ shows a significant imbalance. Majors will require larger players to keep outsourcing confidently. Today Majors have limited options for their manufacturing strategy: outsourcing more would mean reaching out for smaller CMOs, and they are reluctant to increase the number of suppliers.



Top 5 Majors COGS
 5.8 BUS\$



Top 20 CMOs:
 3 BUS\$
 53% of CM
 market

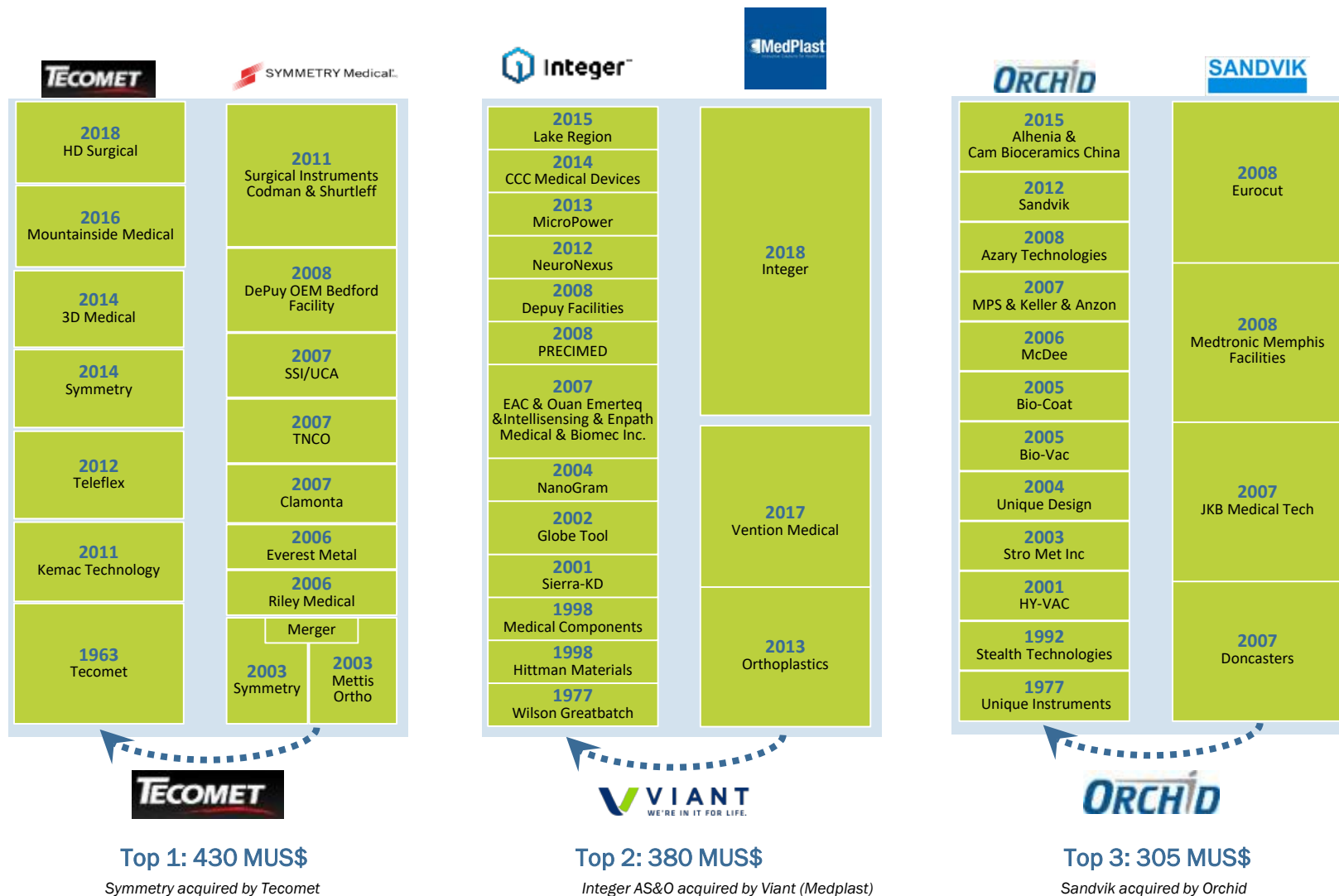


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Orthopaedic Contract Manufacturing concentration by acquisition



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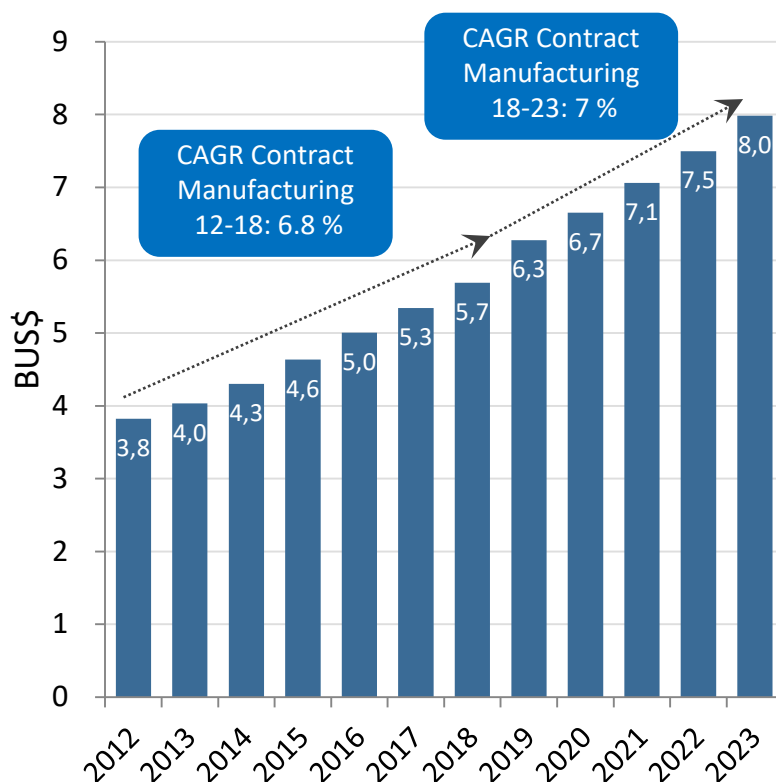
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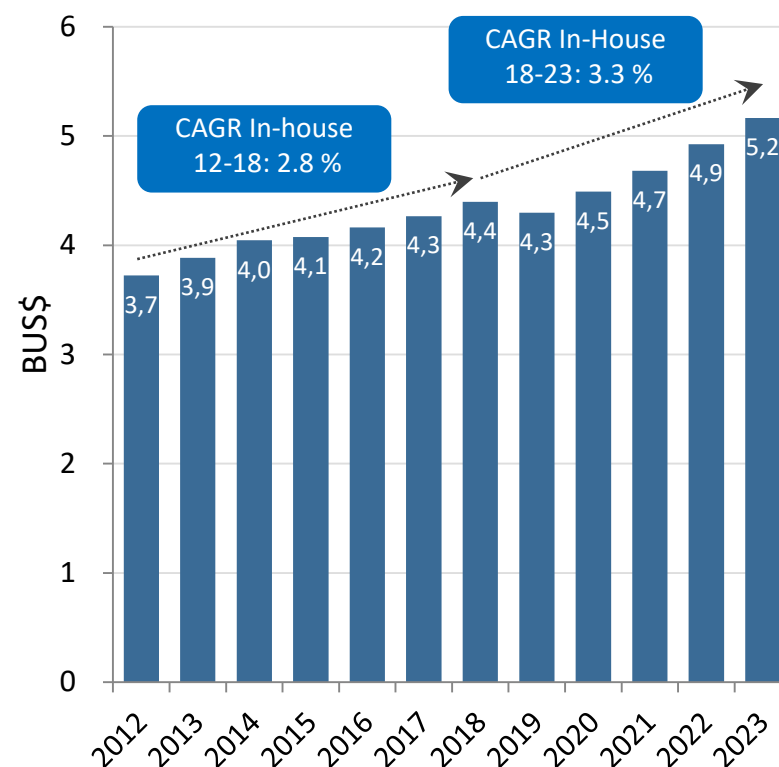
The Orthopaedics Contract Manufacturing market is growing faster than In-house manufacturing

In-house manufacturing is growing at a lower rate than overall market growth, hence Contract manufacturing is capturing the difference.

2012-2023 Orthopaedics
Contract Manufacturing (BUS\$)



2012-2023 Orthopaedics
In-house Manufacturing (BUS\$)



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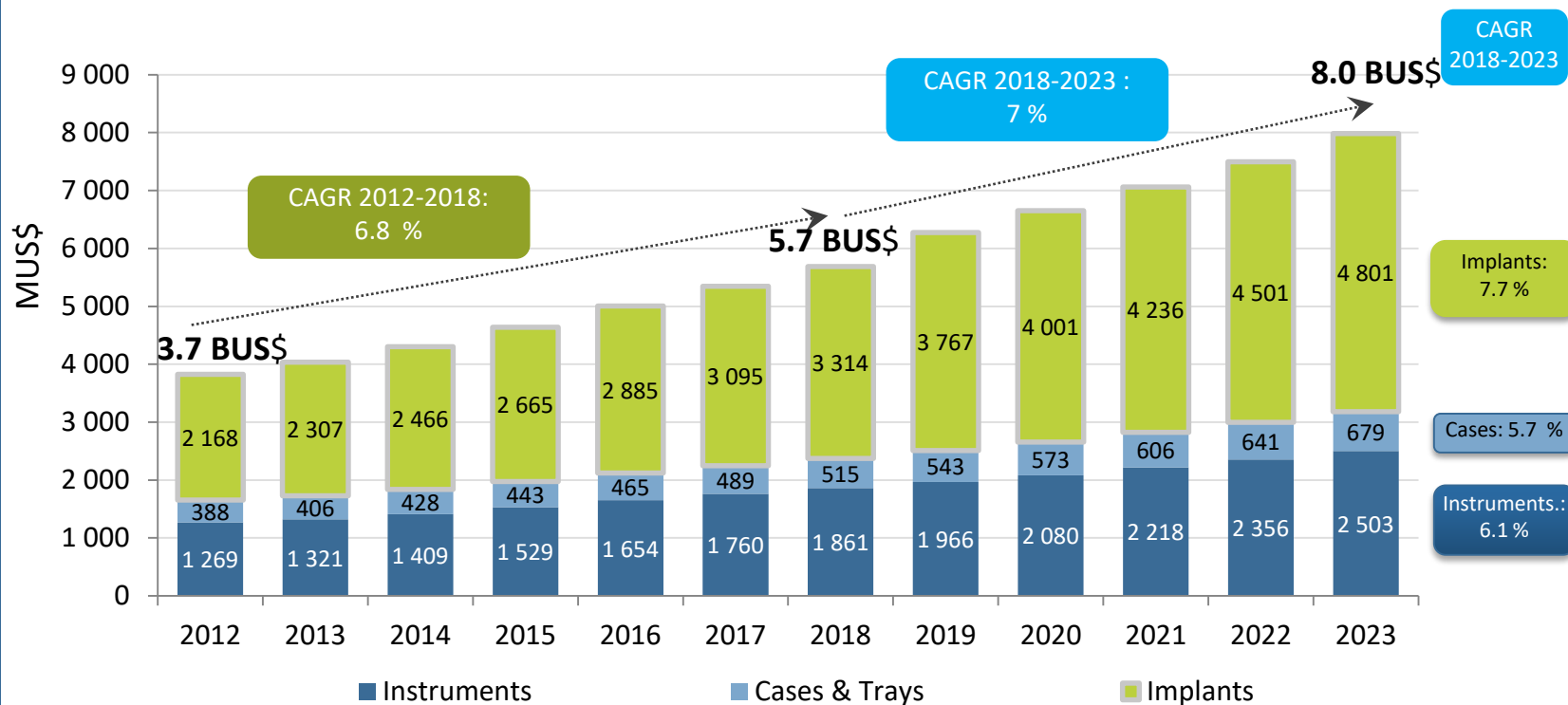
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Source: Avicenne analysis 2019

Contract Manufacturing market is growing at 7 % per year, a faster rate than the orthopaedic market

Main drivers for this faster growth are: Challengers who outsource more are taking away market share from Majors and gradual divestment from Majors.



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Source: Avicenne research & analysis 2019

OEM facility disinvestments: Huge impact of Depuy Synthes – Jabil deal for 2019

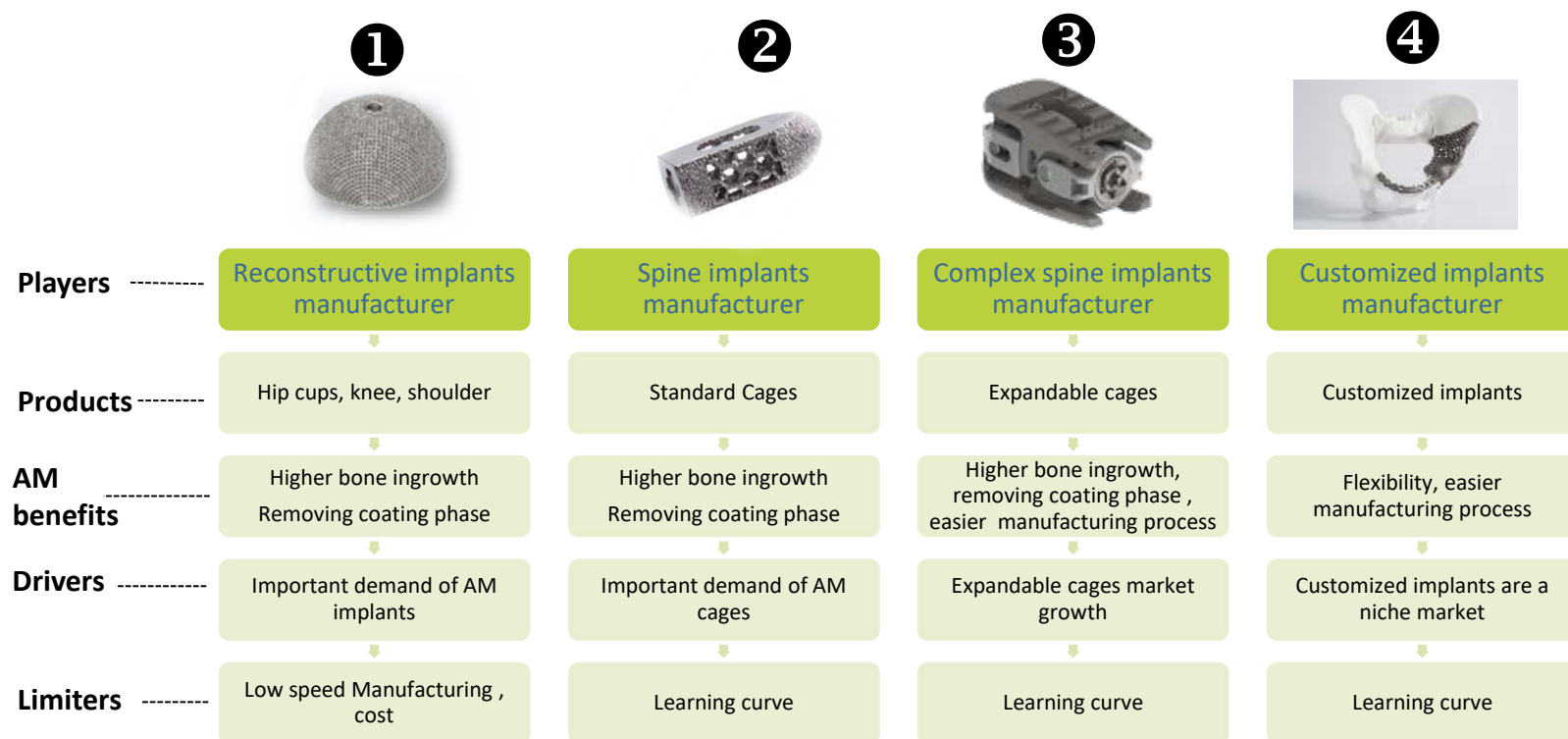
Contract Manufacturing market will be boosted by Depuy Synthes – Jabil deal . Depuy disinvestment concerning 14 facilities worldwide include 7 in Switzerland.

Depuy Synthes Switzerland facilities to be disinvested

Cantons	Facilities	Workforce	Ortho. activities
Solothurn 	Grenchen	320	✓
	Bettlach	370	✓
	Balsthal	110	✓
	Hagendorf	340	✓
Neuchatel 	Le Locle	250	✓
Wallis 	Raron	235	✓
Ticino 	Mezzovico	560	✓

Is Additive Manufacturing the right option for the implant Contract Manufacturing business? Analysis of different products & players for reconstructive implants, cages and customized implants

Reconstructive Contract Manufacturers will see a growing demand for Additive Manufacturing! "Standard" cages made by Additive Manufacturing will reach the mass market. For some complex or customized implants, Additive Manufacturing represents an easier manufacturing process and removes many steps compared the machining process



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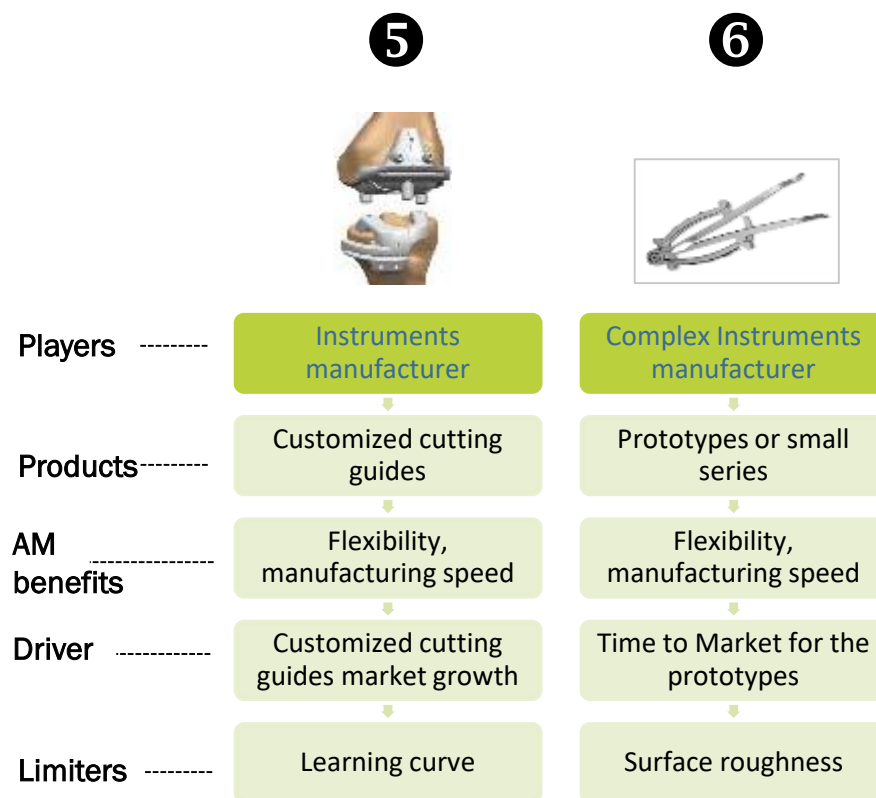
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Source: Avicenne analysis 2018

Is Additive Manufacturing the right option for the instruments Contract Manufacturing business? Analysis of different products & players for customized cutting guides and complex instruments

Instruments manufacturers will increasingly use Additive Manufacturing, which gives higher flexibility for the customized cutting guides and certain complex instruments. The time to market is the main driver for these instruments.



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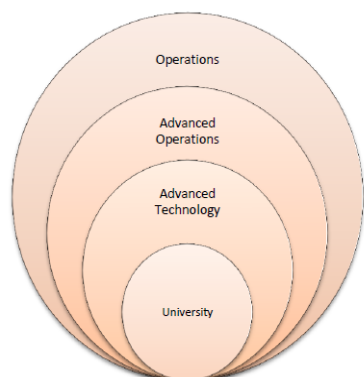
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Stryker announced massive investments in 3D Printing

In 2016 a \$400 million plan to build a 3-D printing manufacturing facility in Ireland was released

Stryker's History of 3D Printing



2001: Research begins with University
 2007: 1st Prototype Equipment in Stryker Facility
 2011: 1st Production capable hardware & software delivered to Stryker
 2013: 1st surgeries: Triathlon tibial baseplate

stryker



Tritanium®

In-Growth Technology[†]
Built to fuse™



March 2018: FDA Clearance for 3D-Printed Tritanium TL Curved Posterior Lumbar Cage



Sept. 2018: MOJAVE PL 3D spinal lumbar complex cage from K2M (acquired by STRYKER)

2001

2011

2016

2018

2007

2013

2017

2018-2019: Stryker expand massively its 3D printed spine cages portfolio



Tritanium 3D printing technology from Stryker

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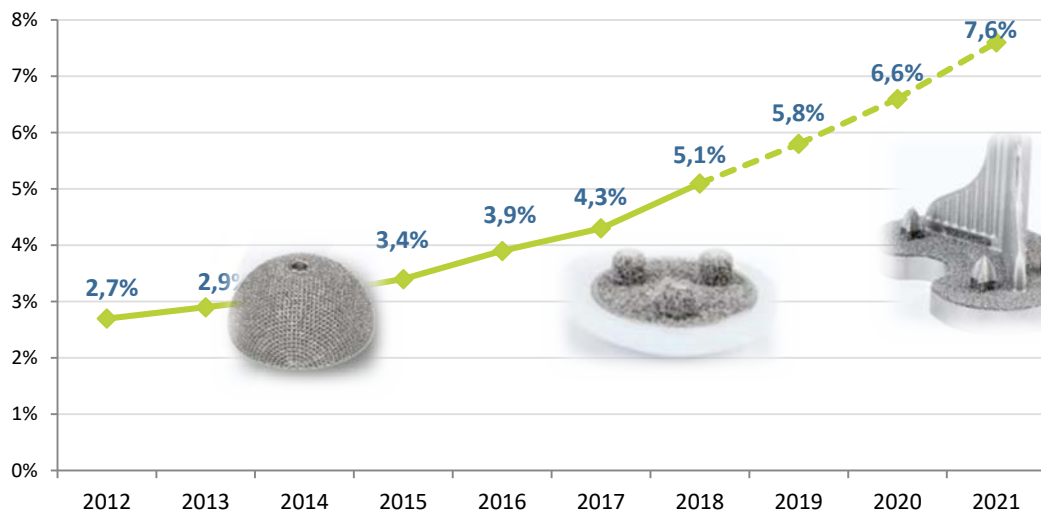
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With permission of Stryker

Additive Manufacturing has today a slight impact on forging, casting & machining of implants. In 2018, we estimate in Europe that less than 6% of all parts of the hips, knees, shoulder, trauma are made by Additive Manufacturing.

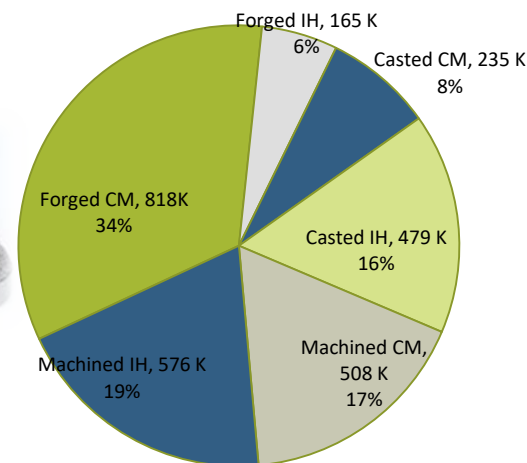
- Additive Manufacturing focuses mainly on cementless implants. In 2018, 5.1 % of all hip, knee, shoulder, trauma are made with Additive Manufacturing. The rest are forged, casted or machined.
- In 2021, we estimate at 7.6% of the total hip, knee, shoulder, trauma parts will be made by Additive Manufacturing.

Europe AM market shares (nb of pieces/ total) 2012-2021: Hip, knee, shoulder, trauma



Source: Avicenne analysis

3 million units Hip cups manufactured worldwide by processes



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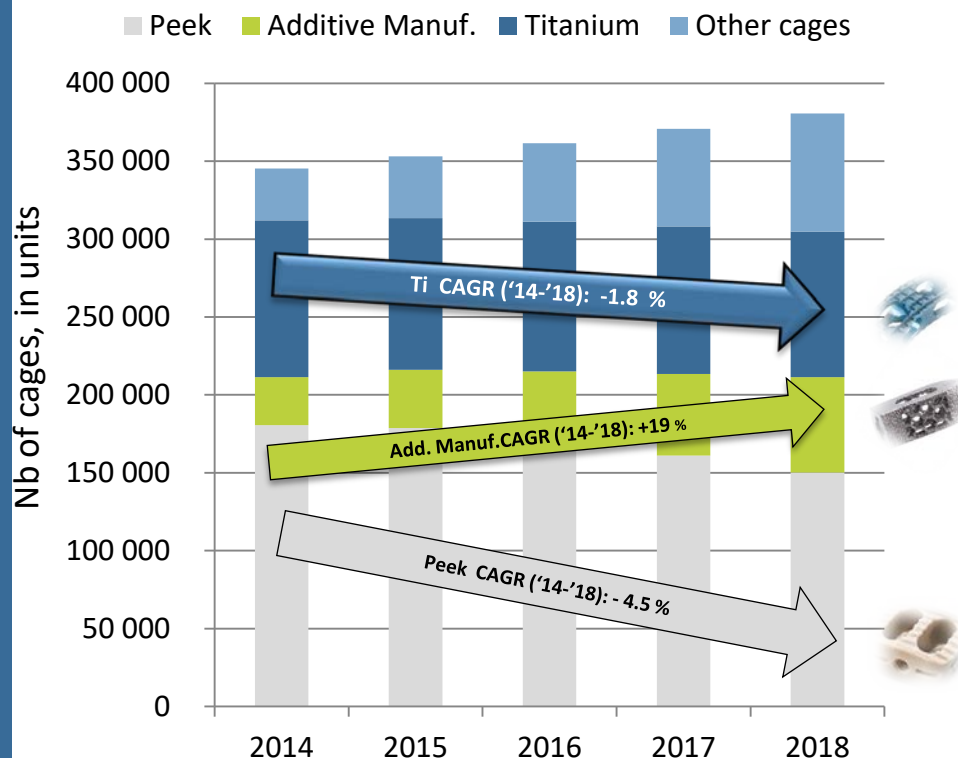
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** Total hip cups in Europe in 2018: 1,034,000 units

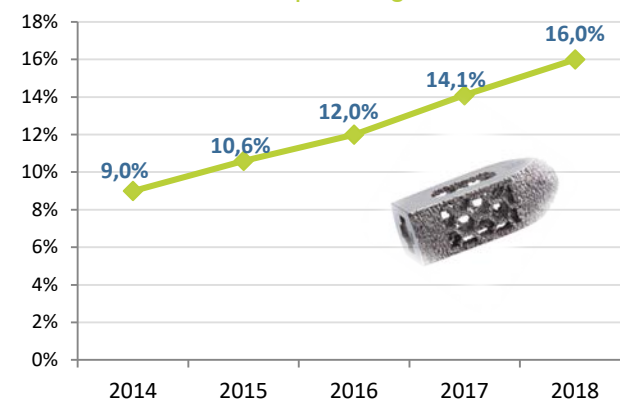
*** Addressable market: Cementless

Cage Raw Materials in the five main countries in Europe: As Peek and Titanium lose market share, Additive Manufacturing for cages increases dramatically

In Europe, when Peek cages lose market share (-4.5 % CAGR by 2018) and Titanium cages also decrease by -1.8 % in the five main countries, Additive Manufacturing & Trabecular cages will increase by 19 % and achieve more than 61,000 units in 2018.



Europe AM market shares (Nb of pieces/ total) :
Spine cages



Source: Avicenne analysis 2019

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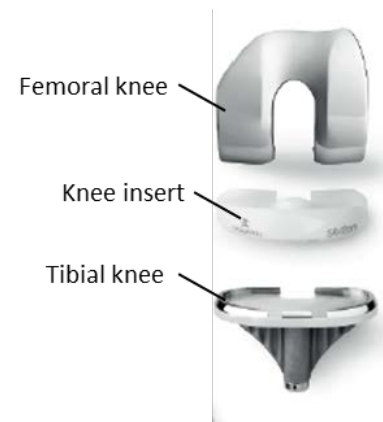
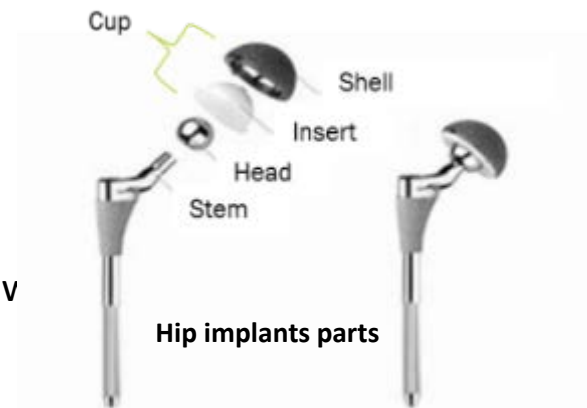
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Source: Avicenne analysis

Raw Materials

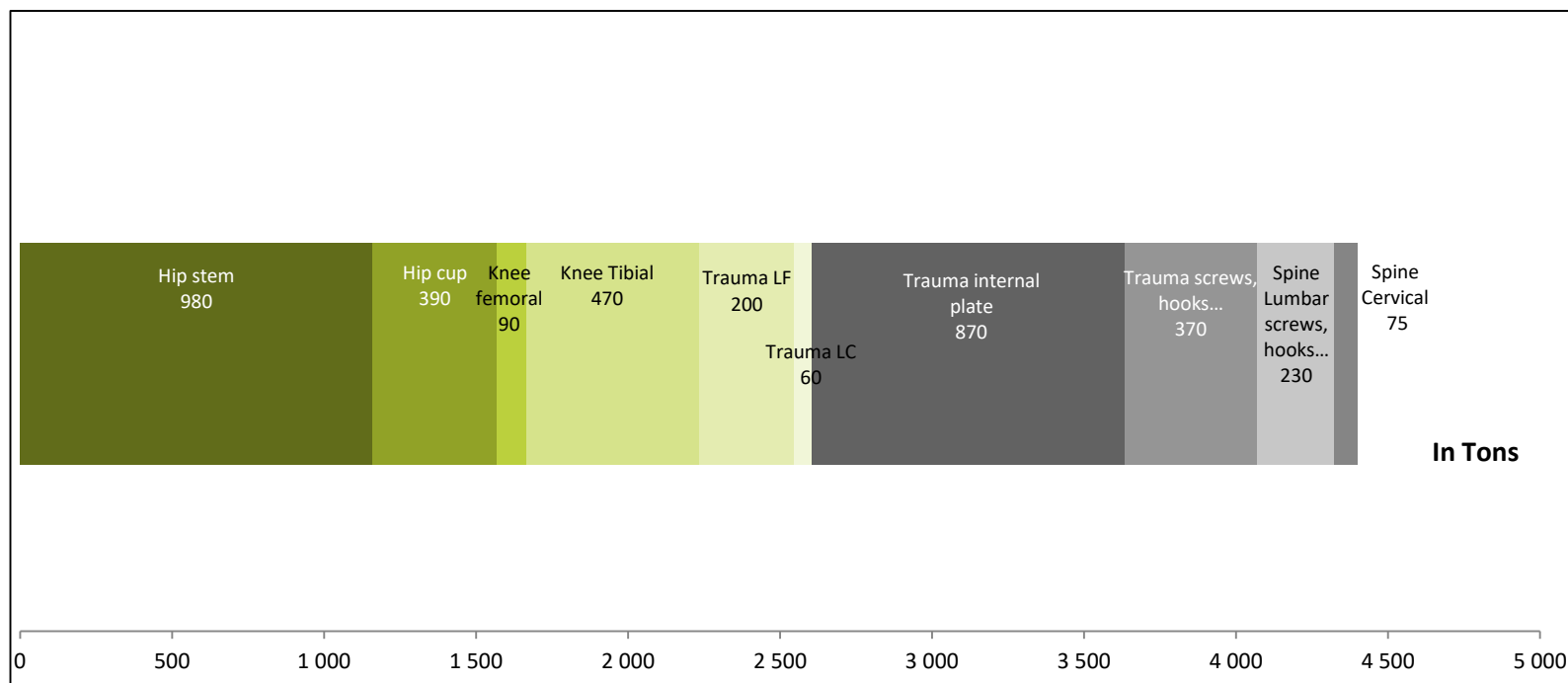
- 🕒 Hip, knee, Trauma & spine: Raw materials and manufacturing process
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- 🕒 Stainless steel & Cr-Co needs for orthopaedics in 2018
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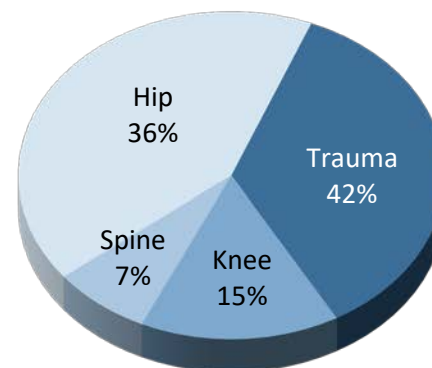
Knee implants parts

Worldwide Titanium consumption for Orthopaedics

Titanium: 4,400 Tons are used for implants in 2018



Titanium used by implants type in 2018



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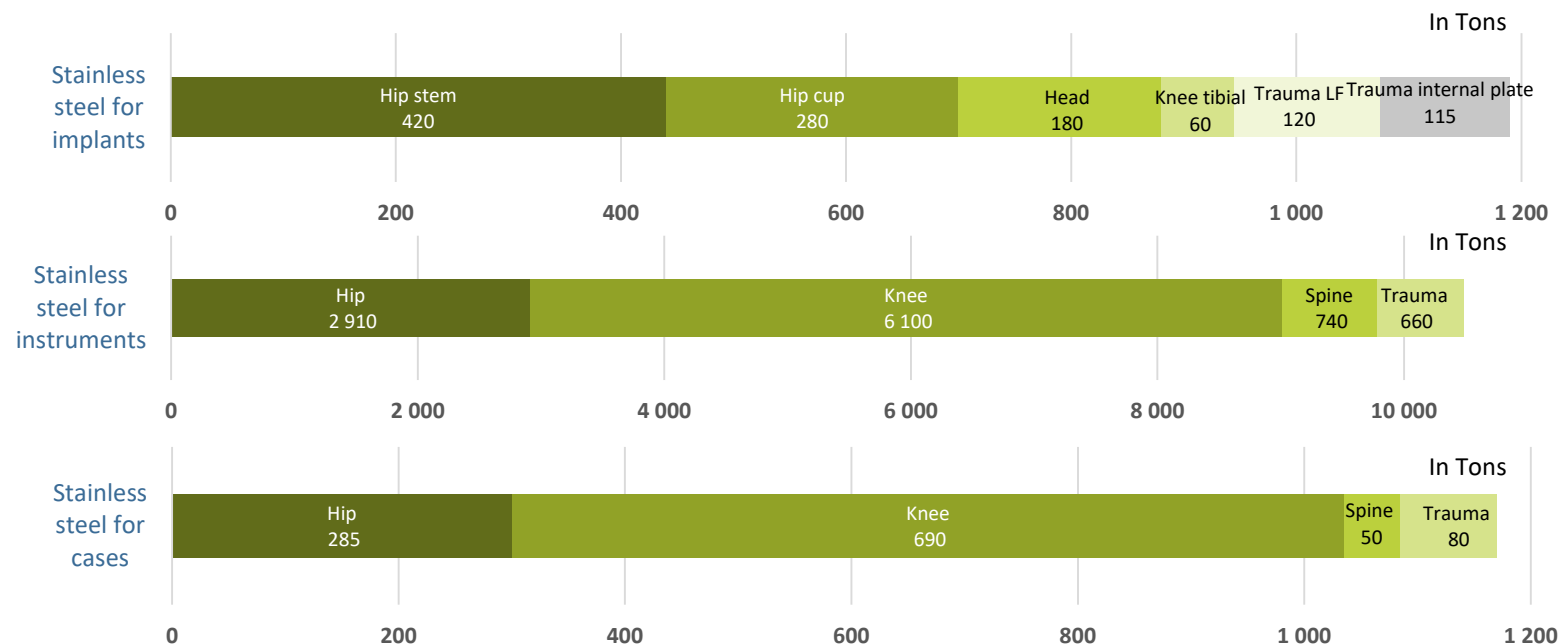
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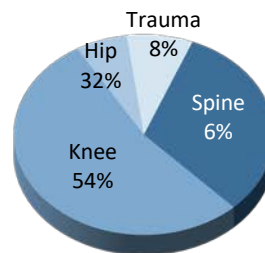
Source: Avicenne 2019

Worldwide Stainless steel consumption for orthopaedics in 2018

Stainless steel: 12,900 Tons are used and 80%+ for instruments in 2018

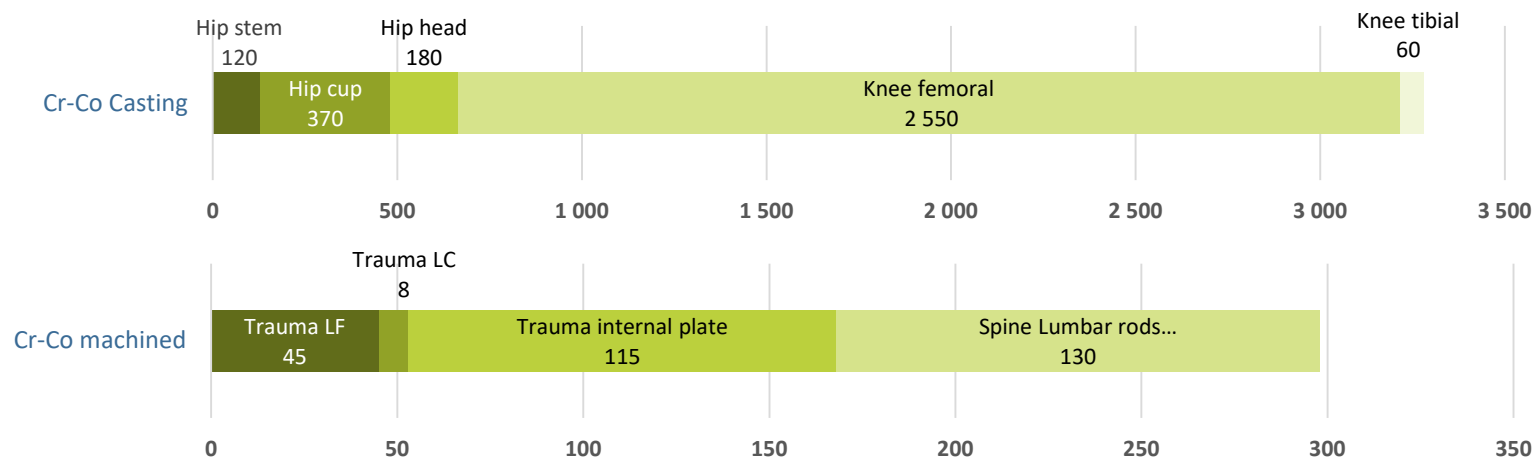


Stainless Steel used by segment in 2018

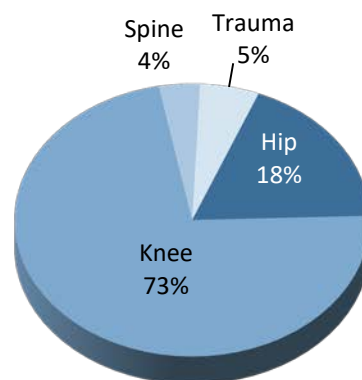


Worldwide Cr-Co consumption for orthopaedics in 2018

Cr-Co: 3,600 Tons are mainly used for knee implants in 2018

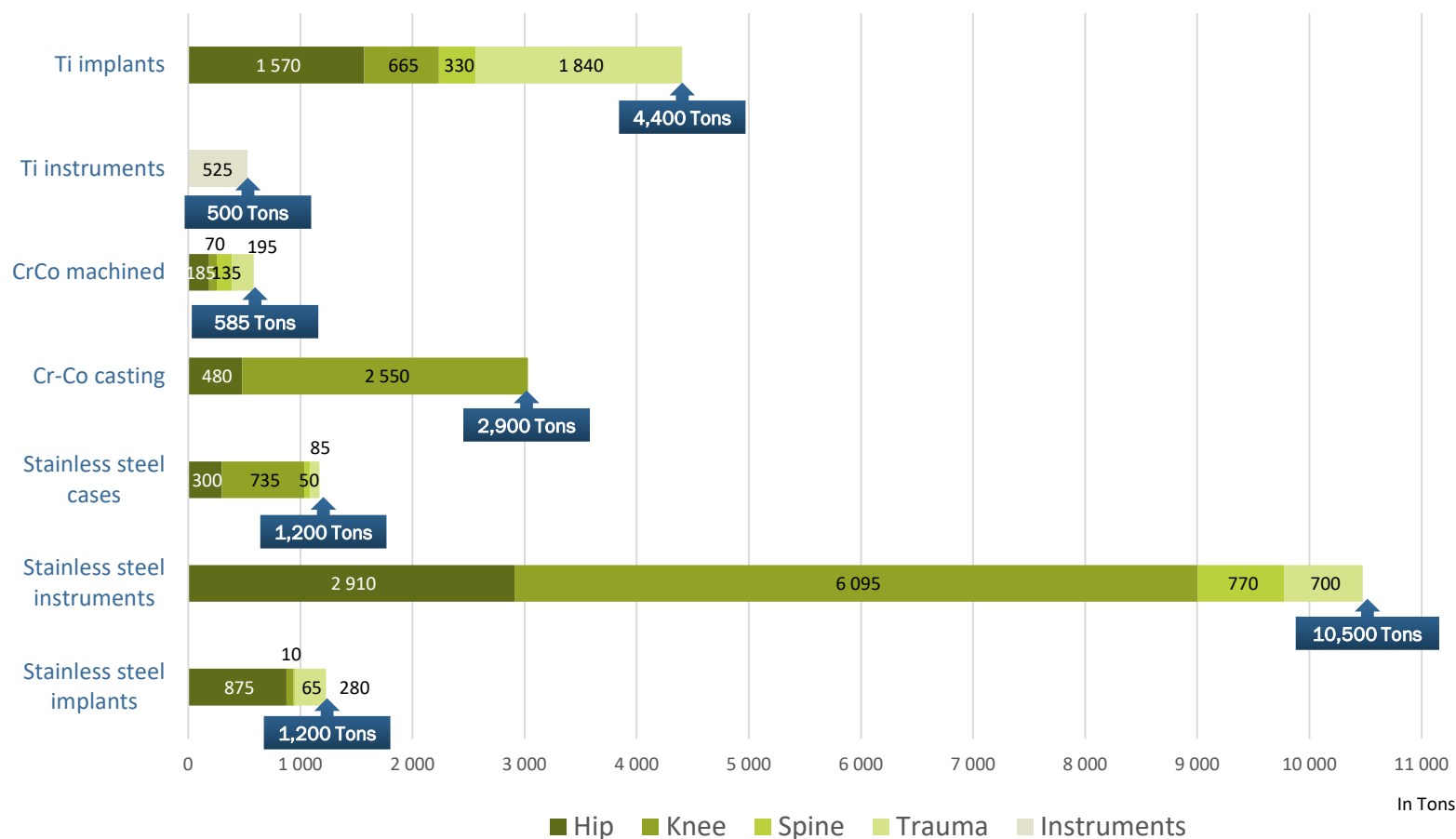


Cr-Co used by implants type in 2018



Worldwide Raw materials by material type & process in 2018

4,900 Tons of titanium are used in Orthopaedics, 3,600 Tons of Cr-Co
10,500 Tons of Stainless steel are used to manufacture instruments,
1,200 Tons to produce implants and 1,200 Tons to manufacture cases



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Source: Avicenne 2019

Worldwide raw materials by implant type

10,500 Tons of raw materials are used for knee and 6,500 Tons are used for hip in 2018



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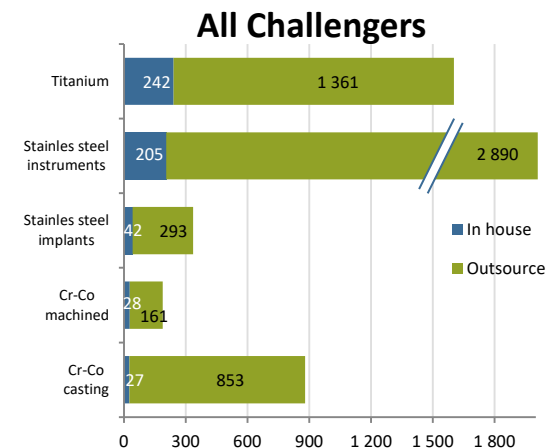
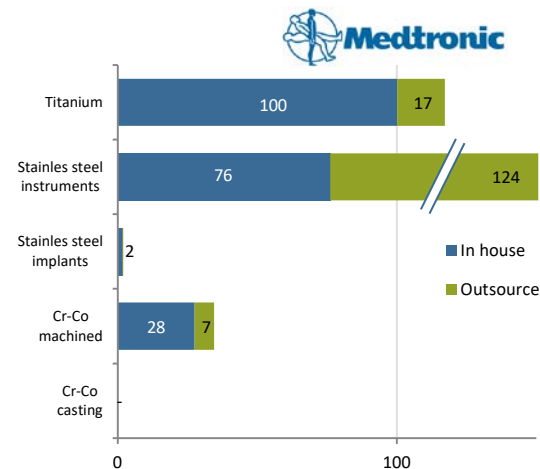
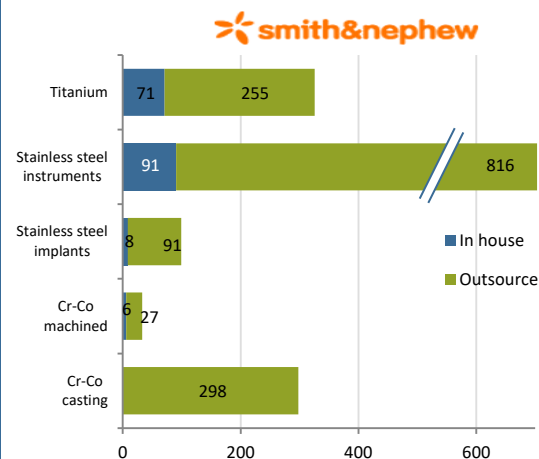
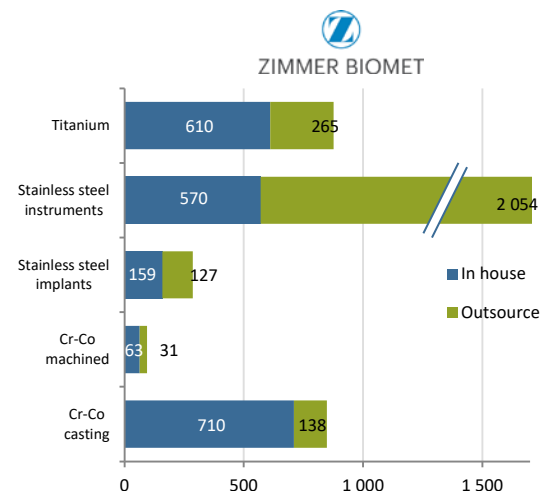
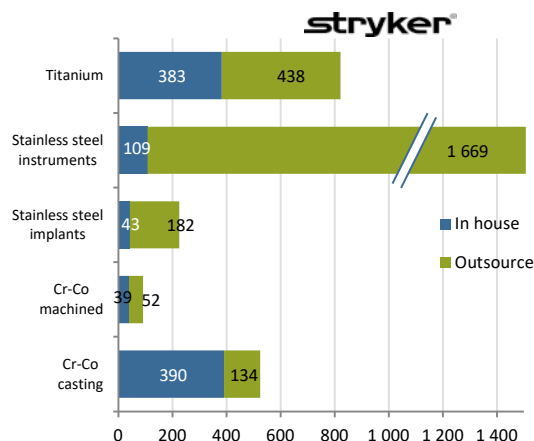
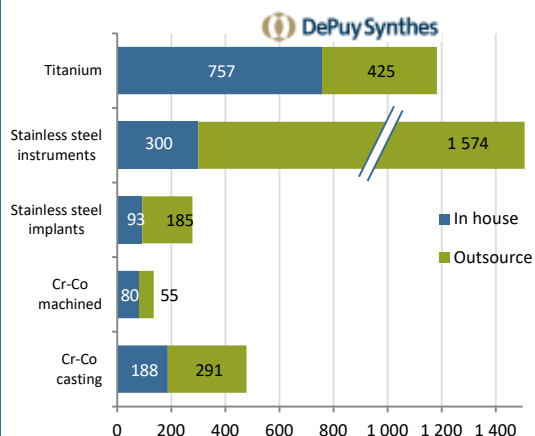
Worldwide raw materials needs by OEMs in 2018

Titanium needs in Tons for orthopaedic players:

The Majors, 1900 Tons of Titanium for in-house Manufacturing and 1400 Tons for their Contract Manufacturing.

The Challengers: 240 Tons in-house & 1350 Tons for CM.

55% of Titanium use is by the contract Manufacturers.

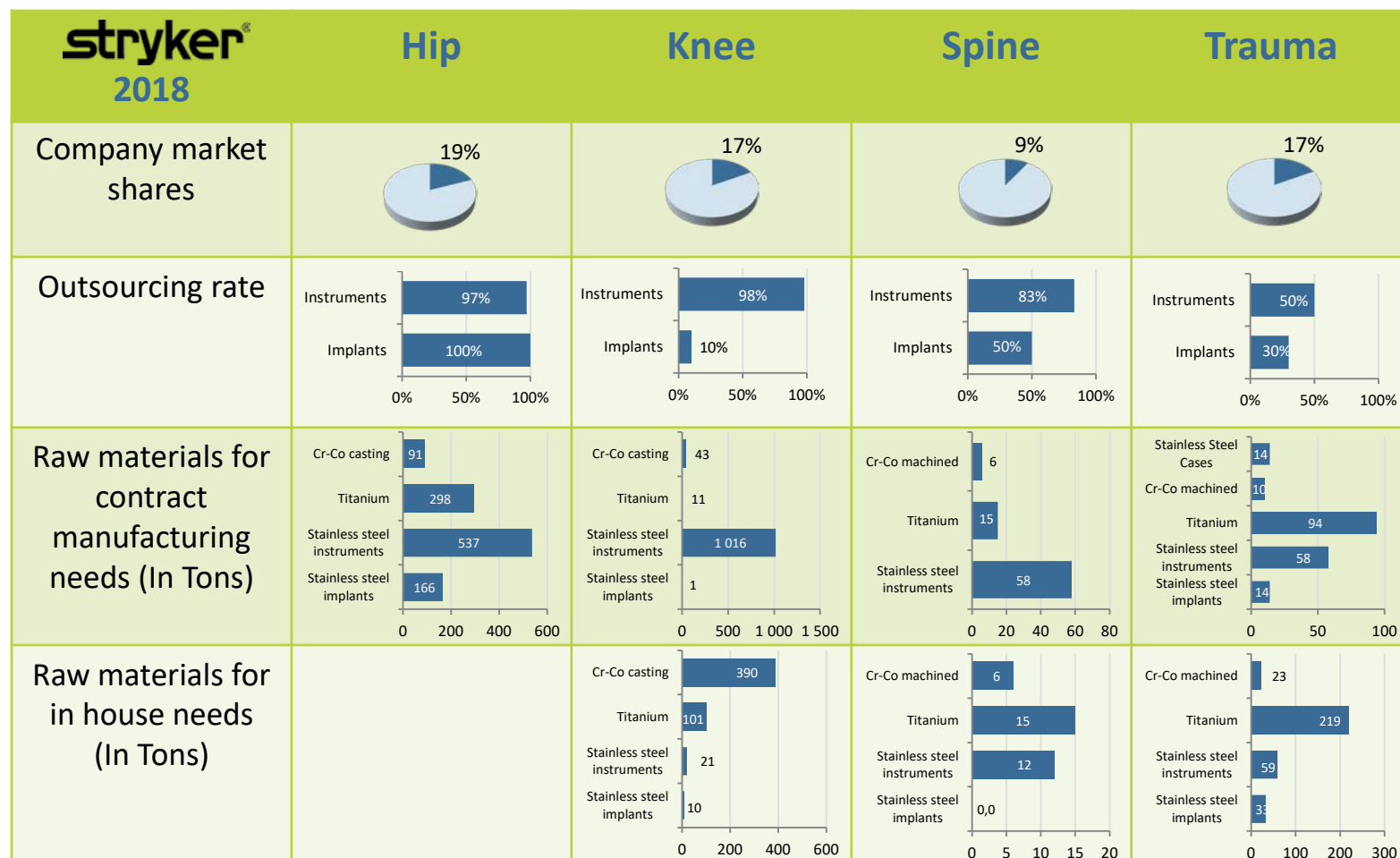


Source: Avicenne 2019

STRYKER raw materials needs in 2018:

In house needs: Titanium 385 T

Outsourcing needs: Titanium 440 T



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Take home messages (1/3)

- 📌 The orthopaedics market, including hip, knee, spine, trauma, extremities and orthobiologics accounted for more than US\$44Bn in 2018.
- 📌 In 2000, the orthopaedic market was US\$11Bn. It grew to US\$44Bn in 2018, and will achieve more than US\$54Bn in 2023. This represents an average of 4% growth in the coming years.
- 📌 Even the 5 major companies, controlling 58% of the worldwide orthopaedics market, have continuously lost market share to the challengers. The challengers have gained 1 to 2% market share per year achieving US\$18Bn in revenue in 2018
- 📌 To manufacture implants, instruments & related products, orthopaedic companies in 2018 spent US\$4.4Bn in-House (+3.1 % vs 2017) and paid their contract manufacturers US\$5.7Bn (+6.5 % Vs 2017).
- 📌 In the Orthopaedic Contract Manufacturing market in 2018, Challengers accounted for US\$2.7Bn, a high amount explained by their higher rate of outsourcing and faster growth, followed by Depuy Synthes (US\$1Bn), Zimmer Biomet (US\$0.7Bn), Stryker (US\$0.65Bn) and Smith & Nephew (US\$0.45Bn).

Take home messages (3/3)

- 🕒 The Majors want to reduce the number of their Contact Manufacturers. The response to this need is Contract Manufacturing market concentration (this is already happening).
- 🕒 In 2019, The CM market will be hugely impacted by the Depuy Synthes–Jabil deal including a massive disinvestment of 14 facilities by Depuy Synthes.
- 🕒 While increased outsourcing is a heavy trend, a few rare, specific cases show that some players in the spine market want to internalize a small proportion of their manufacturing. In our view, this will not modify the general evolution of Contract Manufacturing, where outsourcing is set to remain the dominant trend.
- 🕒 The Contract Manufacturing market benefits from the main orthopaedic drivers: population ageing and product mix evolution. It also has its own intrinsic drivers: OEM implant facilities divestments and the growth of challengers' market share, which is significantly bolstering this market, due to their high outsourcing rate.
- 🕒 By 2023, the Contract Manufacturing market will still be growing faster than In-House.
- 🕒 Contract Manufacturing will remain a robust market with 7% CAGR by 2023.

Take home messages (3/3)

- ✎ In 2018, more than 600 Additive Manufacturing machines produced orthopaedic implants.
- ✎ Stryker announced a \$400 million plan to build a 3-D printing manufacturing facility in Ireland and Depuy Synthes US\$40M.
- ✎ Market growth 2018-2023 for Metal Additive Manufacturing will be between 20% and 30%, according to several industry forecasts. Orthopaedic applications will be one of most dynamic segments, with almost 20% growth per year.
- ✎ 4400 Tons of Titanium were used for Implants in 2018. Hips and trauma accounted for almost 80% of this volume.
- ✎ 500 Tons of Titanium are used for the orthopaedic instruments.
- ✎ Titanium needs in Tons for orthopaedic players: the Majors, 1900 Tons of Titanium in-house and 1400 Tons for their Contract Manufacturing. The Challengers: 240 Tons in-house & 1350 Tons for CM.
- ✎ 55% of Titanium use is by Contract Manufacturers.



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INFORMATION FOR GROWTH

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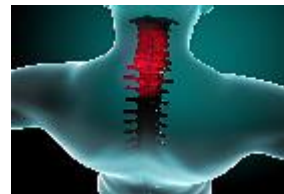
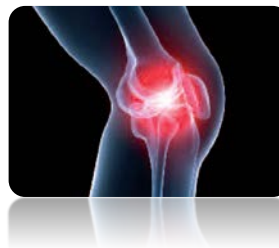
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Strategic Market Research & Transaction Services for the Orthopaedic industry

Avicenne Medical company profile

March 2019



A diversified service offering

Based on 27 years of experience in Orthopaedics

Transaction Services

Strategic Market Research

Vendor Due Diligence	Strategic & Commercial Due Diligence	Management team assessment	Build up & Target research	Customized Strategic research	Key Opinion Leaders surveys
Sizing and market dynamics Detailed market analysis and positioning of the company Management interviews Company differentiation & keys to grow market share Business Plan	Formal Due Diligence based upon: - interviewing industry experts & competitors - Product portfolio assessment - Customer portfolio analysis - Manufacturing organization assessment & site visits - Routes to create value	Strengths & Weaknesses of management team Identification of suitable candidates to strengthen Management capabilities	Screening & Identification of potential targets Target Assessment Introduction & Initial discussions	Diversification Market entry Geographic expansion New Product assessment & launch Worldwide Market shares tracking for emerging products	Key Opinion Leader's usage & preferences for orthopaedic products Survey for opportunities & risks of launching new products Company reputation survey with surgeons

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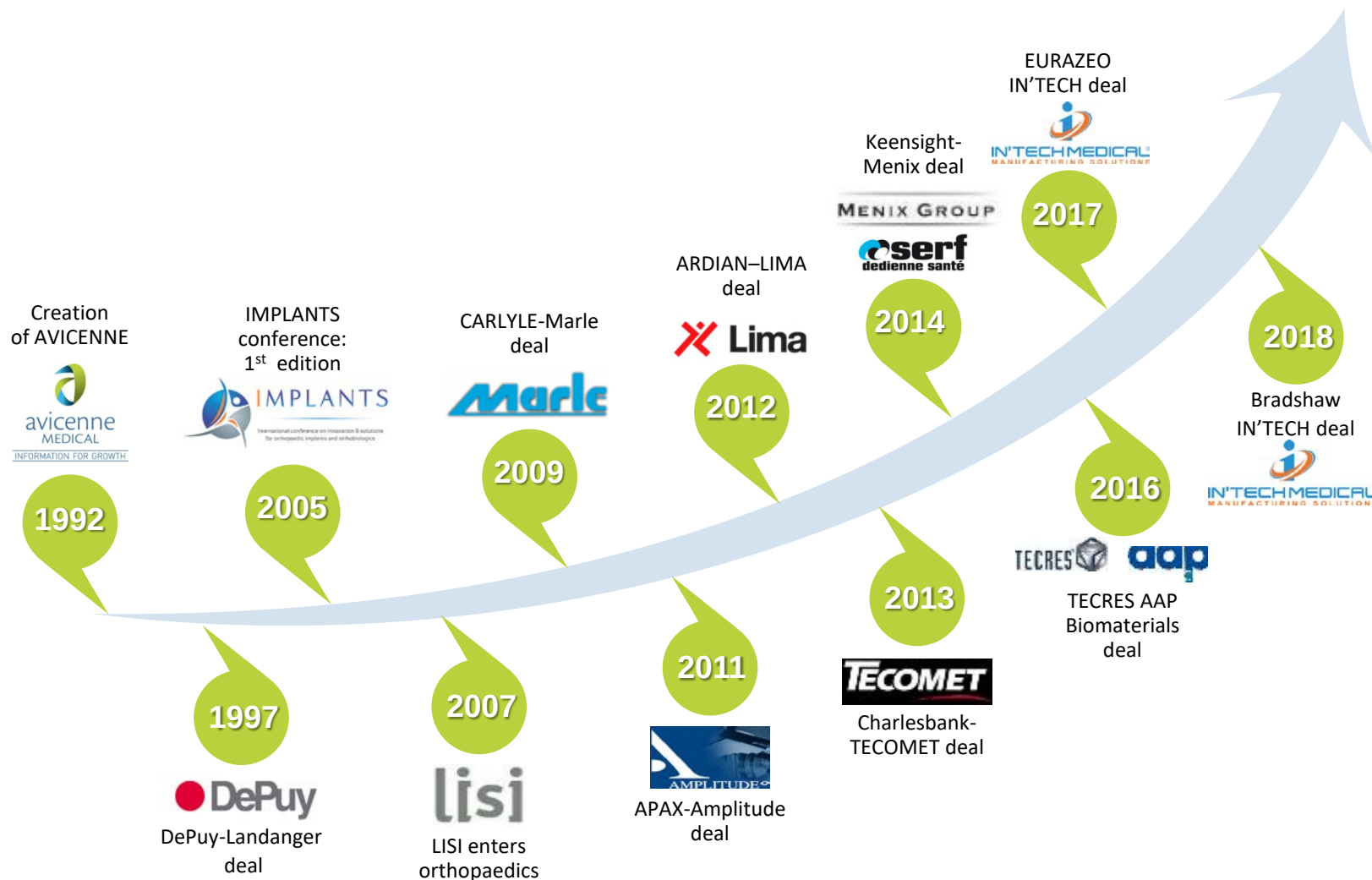
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Our story: Avicenne has been involved in most of the major deals & events within the Orthopaedic Industry

Strategic Due Diligence expertise with a long track record of successful acquisitions for our clients



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Avicenne's long track record of successful acquisitions for our clients

 IN'TECH Medical was acquired by EURAZEO PME Avicenne advised the Buyer <i>June 2017</i>  	 TECOMET was sold by Charles Bank Avicenne advised the Vendor <i>April 2013</i> 	 AAP Biomaterials was acquired by Keensight Capital & TECRES Avicenne advised the Buyers <i>May 2016</i>  	 Bradshaw was acquired by IN'TECH Medical Avicenne advised the Buyer <i>June 2018</i> 
 LIMA was acquired by Ardian Avicenne advised the Buyer <i>September 2012</i>  	 Amplitude was acquired by APAX Avicenne advised the Buyer <i>April 2011</i>  	 MARLE was acquired by Carlyle Avicenne advised the Buyer <i>April 2009</i>  	 MENIX GROUP was acquired by Keensight Capital Avicenne advised the Buyer <i>April 2014</i>  

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Our methodology

A dense contact network built over 27 years

Our contact network



32,000+
qualified contacts

Our Orthopaedics database: 32,000+ qualified contacts



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Implants conference

The international meeting on innovations & solutions for orthopaedic implants & orthobiologics chaired by Avicenne, attracts 150+ decision makers. It is both a place to take the pulse of the industry and a key networking event.

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by AVICENNE since **2005**

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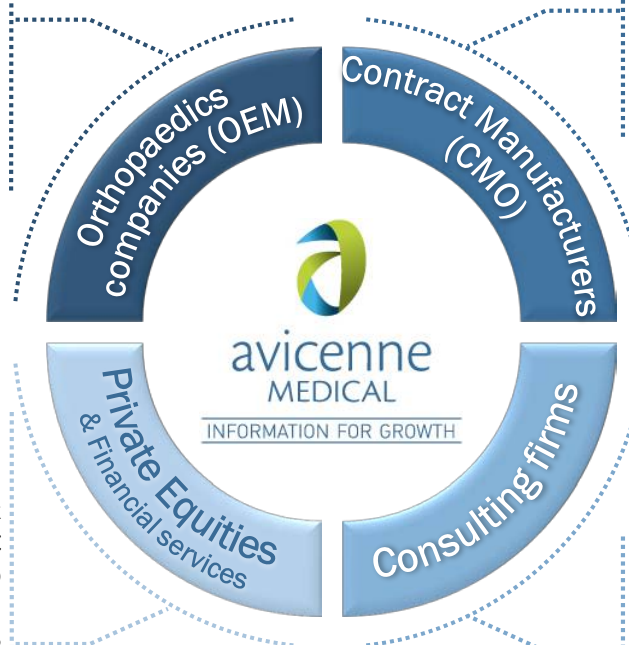
Our customers

Aesculap-B Braun, Amplitude, Aston Medical, Bioland, Biomet, Biomicron, Ceraver, Cousin-Biotech, Dedienne, Depuy Synthes, Eurospine, Evolutis, Exactech, FH, FX Solutions, Geistlich, Help Ortho, Implanet, Implant Industries, Integra Life Sciences, Kisco International, Lepine, Lima, Mathys, Medtronic, MBA, Medacta, Nexis, OST, Ortho Baltic, Orthosoft, Ossacur, Osteotech, Plus Ortho, Progenor, SEM, Seremm, Scient'x, Smith & Nephew, SME, SMI, Stryker Corp, Stryker Limerick, Stryker Spine, Spineway, SGM-Codim, Stanmore Implants, Stryker, Summit Medical, Surgical Devices Pty, Symbios, Tornier now Wright Medical, Transtructure, Transysteme, Zimmer Biomet, Wright Tornier, X'Nov...

Autocam Medical, Addup Solutions, Avalign Technologies, Ceramtec, Cetim, EOS, Eurocoating, Finetubes, Foriginal, Geoffroy, Integer-Greatbatch now Viant, HWG, In'tech Medical, Inomed Technology, Invibio Victrex, Ionbond, Jabil Medical, Jenoptik, Heptal, Komet, LISI Medical, Manoir Industries, Marle, Mediliant, Medin Technologies, Metal Craft & Riverside, Nowak, Nypro, Oerlikon, One Ortho, Orchid Orthopedic Solutions, Paragon Medical, PolymerExpert, Projection Plasma System, Sandvik, Seabrook Medical, Stainless, Straits Orthopedics, Somepic, Surgical Devices Pty, Symmetry Medical, Tecomet, TE Connectivity, Terolab Surface Medical, Vaccucast, VSMPO Tirus, Wichard, Willemin Macodel, Zollern,...

Apax Partners, Altor Equity Partners, Alpha Associés Conseil, Ardian, Argos Soditic, Banque Lazard, BIP Investment Partners, Capzanine, Carlyle Group, Charlesbank Capital, Clayton Dubilier & Rice, CM-CIC Investissement, EKKIO Capital, Eurazeo PME, European Capital, Goldman Sachs, Keensight Capital, LBO France, NATIXIS Partners, PAI Partners, Permira, Piper Jaffray, Pragma Capital (now Sparring Capital), Rothschild Five Arrows, Simuval, Tikehau, Tinicum, UI Gestion, Warburg Pincus, Zurmont Madison...

Arthur D. Little, AT Kearney, Alvarez et Marsal, Bain & Company, Boston Consulting Group, BC Partners, Health Advances, KPMG Strategy, LEK Consulting, McKinsey & Company, OC&C Strategy, Oliver Wyman, Roland Berger...



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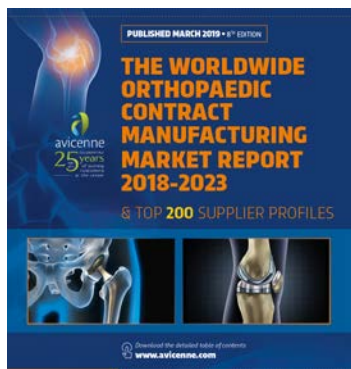
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AVICENNE's off the shelf market reports

"Worldwide orthopaedic Contract Manufacturing market report 2018-2023 & Top 200 supplier profiles" March 2019 8th edition

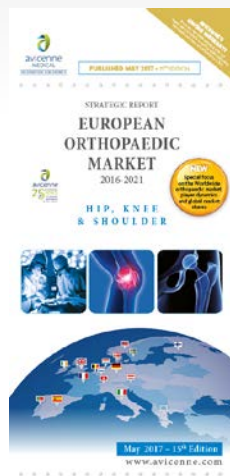
- 🔗 First published in 2014
- 🔗 OEMs strategy for outsourcing & home-made
- 🔗 Detailed markets & sizing for:
 - 🔗 Forging: hip stem, hip cup, femoral knee...
 - 🔗 Casting: femoral knee, tibial knee, hip cup...
 - 🔗 Hip, knee, spine & trauma and instruments machining & finishing
 - 🔗 Cases & trays: hip, knee, spine, trauma
 - 🔗 Coating: stem, cup, femoral, tibial
 - 🔗 Ceramics: hip heads, hip liner
 - 🔗 Cleaning & packaging...
 - 🔗 Special focus on Raw Materials for orthopaedics: Stainless Steel, Cr-Co & Titanium needs for OEMs and Contract Manufacturers
- 🔗 Top 200 Contract manufacturers detailed profiles



Available
immediately

"European Orthopaedics Market 2018-2023" March 2019 16th edition

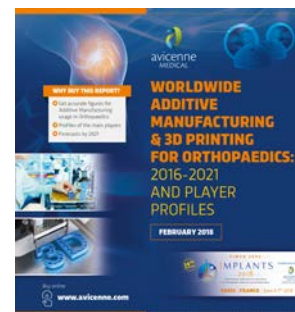
- 🔗 First published in 1993
- 🔗 Yearly up-date
- 🔗 Hip, knee, shoulder
- 🔗 Based on 100+ interviews
- 🔗 810 pages & 1,550+ graphs & exhibits detail the European Market in Germany, France, Italy, Spain, UK, and other countries
- 🔗 Special focus on the worldwide orthopaedic market, player dynamics and global market shares



Available
immediately

"Worldwide Additive Manufacturing for orthopaedics 2016-2021 & player profiles" February 2018 1st edition

- 🔗 First published in 2018
- 🔗 Yearly up-date,
- 🔗 Market for Additive Manufacturing for orthopaedics
- 🔗 Based on 50+ interviews of :
 - 🔗 Additive Manufacturing machine suppliers
 - 🔗 Dedicated companies in Additive Manufacturing (Specialist)
 - 🔗 OEMs heavily invested in Additive Manufacturing or using it extensively
 - 🔗 Contract manufacturers offering Additive Manufacturing service



Available
immediately

"Orthopaedics patent watch" Yearly edition

- 🔗 Focus on 4 segments: hip, knee, trauma and orthobiologics
- 🔗 Report published each 2 months
- 🔗 More than 50 patents presented by number registration and with technical diagrams
- 🔗 On demand:
 - 🔗 Identifying the new products & R&D trends,
 - 🔗 Monitoring your competitor's strategic development choices.



Upon request

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