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Profitability analysis of intraoperative 3D imaging with mobile C-arms – Increasing profitability and improving patient outcomes with the Ziehm Vision RFD 3D

Across the globe, all healthcare stakeholders, including governments, healthcare providers, insurers and consumers, are facing the same competing priorities: meeting the increasing demand for healthcare services and reducing the rising cost of those services.[1] While the pressure to raise quality standards in healthcare and demonstrate value is intensifying, the need to care for patients at manageable costs is growing in parallel. Advances in health technologies and treatment options, followed by methods of increasing efficiency, are recognized as the most important solutions to help answer the challenges of growing healthcare expenditures. This paper showcases how the innovative Ziehm Vision RFD 3D may reduce overall costs while simultaneously leveraging efficiency. In doing so, it answers the trend of rising cost pressure and staying competitive with a top-of-the line mobile C-arm.

The innovation of intraoperative 3D imaging

In the last decade, 3D images have played a vital role during surgery when checking the accurate placement of implants, screws or osteosynthetic material. Other options for intraoperative 3D imaging are open magnetic resonance imaging (MRI) or computed tomography (CT). However, high costs and limited mobility associated with these devices has narrowed their use.[6]

In parallel, the trend toward minimally invasive procedures arose as a way to improve patient outcomes with shorter recovery processes and decrease hospital cost with shorter hospital stays.

Intraoperative 3D imaging with mobile C-arms is therefore recognized as a cost-effective and easy-to-use mobile device in trauma and orthopedic surgery to adjust suboptimal reduction or implant positioning[2] – especially combined with navigation systems to improve minimally invasive procedures.[3]

Through continuous development of the C-arm portfolio, Ziehm Imaging introduced the Ziehm Vision RFD 3D in 2015 with top-of-the-line flat-panel technology, combining 2D and 3D functionalities to offer maximum ease of use.

It has been designed to offer surgeons optimal control of implant position in the OR by providing 3D images of up to seven cervical vertebrae in one scan volume – all in three minutes.

With patented SmartScan technology, the device offers fast 180° image information of even the smallest anatomical structures for precise intraoperative implant control.

Challenges in intraoperative interventions

The intraoperative need for revision of reduction or implant position is not a rare occurance.[3] Especially in complex structures, revision surgeries sometimes cannot be avoided and need to be performed after malpositioning.[2]

The majority of intraoperative revisions can be seen in osteosynthesis of the calcaneus (40.3 %), upper ankle joint (30.9 %) and further complex fractures like in spinal treatment (9.4 %).[2,3] An economical problem in cases of revision surgeries is the fact that these interventions need to be covered with general reimbursement (Diagnosis Related Group (DRGs)), although additional internal extra costs will arise.

Compared to conventional mobile 2D C-arms, higher investment cost for 3D imaging systems are made up for by better patient outcomes and reduction and improvement of revision rates.

That means not only can the quality of performed surgeries be improved for patients and staff alike, but the investment also leads to lower total costs for hospitals and healthcare systems, as postoperative costs will be reduced.

Profitability of 3D imaging

One potential area for savings in 3D imaging can be achieved through intraoperative, CT-like imaging with the Ziehm Vision RFD 3D, which will reduce the need for postoperative CT scans.[3] In total, this is also followed by a higher capacity in the OR and therefore more treated patients, as revision surgeries can be avoided. Through improved workflows and better-planned utilization of the workforce, additional reimbursements can be achieved.[4,5]

Variable cost for additional in-patient stays after revision surgeries, further medical needs, disposables, material costs for mostly new implants during revision, operating costs for the CT, revision surgery and extended inpatient stays as well as additional staff costs will further increase costs for conventional C-arms in comparison with the Ziehm Vision RFD 3D with intraoperative 3D imaging.

Example calculation of different revision surgeries and profitability of the Ziehm Vision RFD 3D

The following calculations demonstrate how quickly and easily the Ziehm Vision RFD 3D helps to improve hospitals' and healthcare systems' financial performance in addition to improving patient outcomes.

The following calculations will show that potential savings for unnecessary postoperative CT scans and revisions amortize higher investments costs within less than 1.25 years in our example calculation of a complex spinal procedure.

The calculation is based on conservative assumptions. The revision surgery is based on an internal average calculation. Therefore, different numbers from academic studies were considered, including cost and salary increases of about 3 % for the last 10 years. Furthermore, 30 % of the current DRG for a spinal fusion (B20D) or for a fracture of the calcaneus (I20F) has been calculated as a reference value for the revision surgery. In the following, the amount of 1,900 euros is assumed for a spinal revision surgery and 400 euros for a calcaneus revision surgery.

The examples will describe the costs for a surgery using the 3D C-arm without a postoperative CT scan as well as no revision surgery (but including the same revision rate intraoperatively). Further, the examples show the costs for a regular 2D C-arm-supported surgery, including a postoperative CT and a revision surgery with the above-mentioned revision rates for a spinal fusion or a calcaneus fracture.

In the end, potential savings and a fast amortization rate in comparison to conventional C-arm imaging will be demonstrated.

Spine surgery example

Assumed conditions:
A complex spinal procedure
1 level spinal fusion – placement of 4 pedicle screws
Revision rate of around 10 %
Revision surgery costs of 1,900 €

Number of spinal surgeries performed[a]	300 surg./year
Intermediate revision rate	10 %
Number of revision surgeries performed	30 surg./year

	2D	3D
Staff costs for **one** 3D scan, which takes 10 minutes longer than the 2D[b,c]	0 €	70 €
Staff costs for **one** 5-minute-longer surgery to perform an intraoperative revision (at a revision rate of 10 %)[c]	0 €	35 €
Staff costs for **one** additional postoperative CT[c]	46 €	0 €
Total cost for **one** revision surgery[c]	1,900 €	0 €
Cost comparison for **300** spinal surgeries per year at a rate of **30** revisions (intraoperative or postoperative)	70,800 €	22,050 €

Estimated additional costs for the Ziehm RFD 3D in comparison to a mobile C-arm without 3D capability	61,000 €
Potential savings in comparison to a mobile C-arm without 3D capability[d]	48,750 €/year
Years until pay-off[d]	1.25 years

[a] This number is based on an internal average assumption.
[b] This time includes draping, hyperoxygenation of the patient, breathing stop, the team leaving the OR, image acquisition, and reconstruction, decision time whether a revision is needed or not and patient preparation for intraoperative revision or completion of the surgery.
[c] This number is based on a conservative assumption of an internal average calculation for additional staff costs for longer 3D imaging/intraoperative revision/postoperative CT scan or a complete revision surgery. Different numbers of a literature research were considered, including a cost and salary development of about 3 % for the last 10 years. For the number of additional revision surgeries, furthermore, 30 % of the current DRG rates are considered as a reference value for the revision surgery for a spinal fusion (B20D).
[d] Profitability analysis provided as marketing tool only, Ziehm Imaging is not responsible for nor guarantees any financial outcomes.

Calcaneus surgery example

Assumed conditions:
A complex calcaneus procedure
Revision rate of 40 %
Revision surgery costs of 400 €

Number of calcaneus surgeries performed[a]	300 surg./year
Intermediate revision rate	40 %
Number of revision surgeries performed	120 surg./year

	2D	3D
Staff costs for **one** 3D scan, which takes 10 minutes longer than the 2D[b,c]	0 €	70 €
Staff costs for **one** 5-minute-longer surgery to perform an intraoperative revision (at a revision rate of 40 %)[c]	0 €	35 €
Staff costs for **one** additional postoperative CT[c]	46 €	0 €
Total cost for **one** revision surgery[c]	400 €	0 €
Cost comparison for **300** calcaneus surgeries per year at a rate of **120** revisions (intraoperative or postoperative)	61,800 €	25,200 €

Estimated additional costs for the Ziehm RFD 3D in comparison to a mobile C-arm without 3D capability	61,000 €
Potential savings in comparison to a mobile C-arm without 3D capability[d]	36,600 €/year
Years until pay-off[d]	1.67 years

[a] This number is based on an internal average assumption.
[b] This time includes draping, hyperoxygenation of the patient, breathing stop, the team leaving the OR, image acquisition, and reconstruction, decision time whether a revision is needed or not and patient preparation for intraoperative revision or completion of the surgery.
[c] This number is based on a conservative assumption of an internal average calculation for additional staff costs for longer 3D imaging/intraoperative revision/postoperative CT scan or a complete revision surgery. Different numbers of a literature research were considered, including a cost and salary development of about 3 % for the last 10 years. For the number of additional revision surgeries, furthermore, 30 % of the current DRG rates are considered as a reference value for the revision surgery for a calcaneus fracture (I20F).
[d] Profitability analysis provided as marketing tool only, Ziehm Imaging is not responsible for nor guarantees any financial outcomes.

Conclusion

The cost pressure in healthcare systems is increasing, leading to the need to reduce overall cost. In addition, outcome quality for hospitals and patients alike needs to be increased as a common goal. All healthcare stakeholders therefore demand profitable workflows, clinical efficiency and flexibility. In addition, steady reimbursement cuts and changes in the DRG system force these needs.

Revision surgeries are not reimbursed in the US, Germany or other developed healthcare markets. Decreasing the need for revision surgeries, as they are most expensive cost drivers in hospitals, is therefore one of the most important goals in the healthcare industry.

The two examples outlined in this paper show how patient outcomes, clinical capabilities and improved financial performance can be achieved in parallel – benefiting from the comprehensive innovation in our hands. Even higher investment costs in the beginning can be amortized in short time periods while enhancing further mentioned advantages.

An interactive profitability calculator has been developed on the basis of this paper to better illustrate individual potential savings and amortization.

The profitability calculator is available here:
www.ziehm.com/profitabilitycalculator

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References

[1] Deloitte Healthcare Outlook 2015

[2] Bischoff et al. Wirtschaftlichkeit der intraoperativen 3D-Bildgebung mit einem mobilen chirurgischen C-Bogen, Der Unfallchirurg 2004

[3] von Recum et al. Die intraoperative 3D-C-Bogen Anwendung – State of the art, Der Unfallchirurg 2012

[4] Hartwig E, Schultheiss M, Bischoff M Pauschaliertes Vergütungssystem bei minimalinvasiver Versorgung thorakolumbaler Frakturen. Der Unfallchirurg 2014; 107: 712-715

[5] Hüfner T, Stübig T et al. Kosten- und Nutzenanalyse der intraoperativen 3D-Bildgebung. Der Unfallchirurg 2007; 110:14-21

[6] Richter M, Geerling J, Zech S et al., Intraoperative Three-Dimensional Imaging With a Motorized Mobile C-Arm in Foot and Ankle Trauma Care, Journal of Orthopaedic Trauma 2005;19:259–266