Healthcare Improvement Scotland | SHTG Advice on health technologies

Innovative Medical Technology Overview | December 2025

Esaote® low-field extremity magnetic resonance imaging (MRI) scanners for musculoskeletal (MSK) imaging

Key messages

- Esaote® low-field extremity magnetic resonance imaging (MRI) scanners are intended to complement, not replace, conventional high-field MRI scanners. They offer an additional option for musculoskeletal (MSK) imaging.
- The current evidence on the diagnostic accuracy and efficacy of low-field MRI (<1 Tesla (T)) scanners compared with high-field (1.5 T and 3 T) devices is limited. A pilot study found that the 0.31 T Esaote® O-Scan produced lower anatomic detail than a 3 T scanner for fine wrist structures in healthy volunteers, but was better tolerated by patients than the 3 T scanner.[1] A diagnostic performance study showed that a 0.2 T Esaote® extremity scanner detected recurrent tears in postoperative knee arthrography with acceptable sensitivity and, in some measures, superior specificity compared with a 1.5 T scanner.[2]
- No clinical studies directly compare adverse events between low-field and high-field MRI systems. While low-field MRI may reduce risks related to specific absorption rate, implant interactions, and acoustic exposure, the absence of comparative clinical safety data limits firm conclusions.
- Extremity MRI scanners may provide a positive patient experience compared with traditional high-field systems. Features such as an open design, quieter operation, larger bore diameter and flexible coils enhance patient comfort and may increase scan completion rates. These features are particularly beneficial for patients who are claustrophobic, anxious and have certain implants.
- Further data collection is needed to establish the diagnostic accuracy, clinical effectiveness and safety of low-field MRI extremity scanners like Esaote® compared with conventional MRI technology, either through published clinical studies or robust local evaluations.
- There are no published studies directly comparing the cost effectiveness of Esaote® extremity MRI scanners or any low-field MRI scanners versus conventional high-field

MRI scanners in clinical populations. Low-field MRI scanners have lower upfront capital costs and reduced annual operating expenses compared with high-field systems, which may make low-field MRI a more economically viable option for expanding imaging capacity, particularly in settings with resource and infrastructure limitations.

Definitions

Extremity MRI scanners: MRI systems that image the extremities such as wrists, elbows, knees, foot, hand and ankles.

High-field MRI scanners: conventional MRI systems that operate with a magnetic field strength of 1.5 T and above (usually 3 T).[3]

Low-field MRI scanners: MRI systems that operate with a magnetic field strength of less than 1 T.[3]

Magnetic resonance imaging (MRI): a type of scan that uses powerful magnetic fields and radio waves to create detailed pictures of the inside of the body. It is commonly used to diagnose a wide range of conditions, guide treatment planning and evaluate the effectiveness of treatments.[4]

Musculoskeletal (MSK) conditions: affect the muscles, bones and joints and related tissues such as nerves. They can range in severity from minor injuries to long-term conditions.[5]

Background

Traditional high-field MRI scanners (1.5 T and 3 T) are the standard in clinical practice for MSK imaging because of their excellent diagnostic reliability and spatial resolution.[1, 6] Demand for MRI imaging, including for MSK conditions, is high and continues to grow.[1]

Low-field MRI scanners (<1 T) have previously had weaker signal strength and lower image resolution, which often resulted in poorer overall image quality compared with high-field scanners.[6] Technological advances in low-field MRI scanners, such as improved reconstruction methods, multi-channel coil technology and artificial intelligence (AI) assisted image processing, have improved diagnostic performance alongside patient experience.[3, 7]

High-field MRI scanners are associated with claustrophobia, loud noise and long scan times. The impact this has on patients during the scan can degrade imaging quality or lead to incomplete exams[1] as patient comfort and acceptance are important determinants of image quality and completion rates.[8] The open design of low-field MRI scanners can help reduce anxiety-related interruption to scans and mitigate limitations associated with high-field MRI scanners.[8, 9]

The technology and its use

Esaote® manufactures low-field MRI systems for MSK imaging. The scanners operate on single-phase power and have been developed to meet clinical and operational needs in outpatient clinics, orthopaedic departments or community settings. Esaote® scanners can be used for a variety of MSK conditions. This evidence review focuses on the imaging of the peripheral joints and soft tissues of upper and lower extremities (such as wrists, elbows, knees, foot, hand and ankles) in outpatient, radiology, orthopaedic and community settings.[1, 10, 11]

The Esaote® O-Scan Smart® 0.31 T scanner is used for imaging of the extremities. During a scan, the patient remains completely outside the magnet and does not have to enter a narrow, enclosed tube. It has a small footprint, requiring a 3 m^2 radiofrequency (RF) cage and a 1 x 4 m operator and electronics area, giving it the potential to be used a range of healthcare settings.

What is innovative about the technology?

The innovation of Esaote® MRI scanners lies in their low-field, extremity-focused MRI with the potential to be situated in standard clinical environments because of their reduced infrastructure needs (less shielding and simpler installation requirements).[1, 12] Their lower field strengths allow for more open magnet geometries and larger or more accessible bores. These features are associated with lower acoustic noise and facilitate different options for patient positioning, including weight-bearing or seated options.[8, 9, 12] Esaote® MRI scanners operate on an AI powered platform to maximise their speed and image resolution.

The open cage design of Esaote® MRI scanners allows for constant communication between the operator and patient which can help alleviate claustrophobia and reduce the need to use general anaesthesia in patient groups who may otherwise struggle to tolerate standard MRI examinations.[11] Improved patient experience may help decrease the likelihood of incomplete scans and increase patient acceptance of MRI examinations.[8]

What is the value proposition of the technology?

The value proposition of Esaote® MRI scanners is that the low-field MRI offers clinically adequate imaging for defined use cases. The small footprint and lightweight design of the scanners offer installation flexibility to expand imaging capacity which may in turn help reduce waiting times.

Regulatory information

Esaote® MRI scanners meet the requirements for safety and performance under European medical device regulations.

Esaote® MRI scanners have the required documentation for sales within the UK and are available via NHS Scotland Supply Chain and NHS England Supply Chain. (J Manchester, MRI Business Development Manager, Esaote. Personal Communication, 3 September 2025).

Population, setting and intended use

The intended population for the Esaote® extremity MRI scanners includes adults (≥16 years) requiring diagnostic imaging for MSK conditions affecting the extremities. This includes the soft tissue of peripheral joints (wrists, elbows, knees and ankles).[1] The scanners are not designed to replace whole-body or neuroimaging applications of conventional high-field systems, but to act as a dedicated tool for limb and joint imaging. Their clinical role lies in supporting diagnosis of patients with common MSK conditions, facilitating earlier diagnosis, reducing repeat imaging and improving patient throughput.[7, 13]

Public Health Scotland reported that in the quarter ending 31 March 2024, 76,064 patients attended an Allied Health Professional (AHP) led MSK outpatient appointment. This represents a 2% increase compared with 74,560 patients in the same quarter of 2023. On 31 March 2024, there were 78,505 patients on the waiting list to be seen at AHP MSK services, representing a 11% increase from 70,652 patients on the waiting list recorded the previous year (31 March 2023). Of patients on the waiting list in March 2024 across NHSScotland (excluding NHS Lothian, for whom data was not available), 31% had been waiting up to 4 weeks, 53% between 5 and 24 weeks and 16% for more than 24 weeks.[14]

Equality, access and other considerations

We did not identify any studies that described the direct equality impacts of Esaote® extremity MRI scanners.

Conventional high-field MRI scanners are associated with challenges in terms of patient tolerability. Patients may be required to lie relatively still for up to 90 minutes on a hard surface.[9] The enclosed bore design, the loud banging noise and long scan times can contribute to patient anxiety and discomfort.[10]

Claustrophobia is also a recognised barrier, affecting up to 15% of MRI examinations depending on the body region being imaged.[8, 9] One service evaluation reported that claustrophobia was more likely in women, patients aged 45–64 years, those entering the scanner head first and those undergoing head imaging.[9]

Conventional high-field MRI scanners may have limitations for patients weighing above 300 lbs/136 kg, patients with implants that are unsafe in high-field environments and patients who struggle with remaining still for prolonged periods.[10]

Extremity MRI scanners with open, smaller and quieter designs may be beneficial for children.[9] Low-field extremity MRI scanners have the potential to improve equity of access to MRI imaging. High-field MRI scanners are costly and often concentrated in large hospitals or tertiary centres.[6] This can create access disadvantages for patients living nearer smaller hospitals, or in rural areas.

Summary of clinical evidence

The evidence base for the clinical effectiveness and performance of low-field extremity MRI systems is limited across the range of MSK indications.[3]

We identified one systematic review that evaluated the diagnostic accuracy and performance of low-field scanners, in general, compared with conventional MRI scanners, without focusing on any specific manufacturer.[3] The review set out to examine the ability of low-field MRI technology to generate clinically meaningful results when compared with 1.5 T MRI scanner images of the nervous system (spine, spinal cord and brain), MSK structures (muscles, bones and joints) and organs of the pelvis, abdomen and chest. The review included two cross-over observational studies which focused on brain imaging alone.[15, 16] Imaging quality, resolution, contrast and diagnostic value was higher with 1.5 T scanners, but the first study found no statistically significant differences in measured aneurysm sizes between the two MRI technologies. The review concluded that low-field MRI has the potential as a complementary technology alongside conventional 1.5 and 3 T scanners. It recommended further research to identify and define the most appropriate clinical applications for low-field scanners.[3]

Primary studies

We identified two primary studies that evaluated Esaote® extremity scanners. One study, published in 2023, was a pilot of the Esaote® O-Scan (0.31 T) for wrist imaging.[1] The second study, published in 2009, was a diagnostic performance study using an Esaote® model that is no longer manufactured (0.2 T Artoscan®) for postoperative knee meniscal assessment.[2] The studies provide direct, device-specific evidence on image quality, diagnostic yield with and without arthrography, and patient experience.

The 2023 study evaluated the anatomic depiction and overall image quality of paired images from a dedicated 0.31 T Esaote® O-Scan scanner and a 3 T whole-body scanner in ten healthy adult volunteers.[1] Three radiologists independently scored visibility of anatomical details (triangular fibrocartilage complex, intercarpal cartilage, carpal ligaments and peripheral nerves). Across sequences and structures, mean image ratings significantly favoured the 3 T scanner. The 0.31 T Esaote® O-Scan was judged inferior in anatomic depiction and overall image quality. Based on questionnaire responses, patients preferred the dedicated extremity Esaote® scanner in terms of patient experience and tolerability. The study's small sample size and use of healthy volunteers limit the conclusions that can be drawn. The authors recommended follow-up studies focused on patients with actual wrist pathology to determine clinical value.[1]

The 2009 study assessed the diagnostic performance of an Esaote® 0.2 T scanner for meniscal pathology in a postoperative patient cohort (n=95).[2] The study compared the Artoscan® extremity magnet with a 1.5 T whole-body scanner. Using arthroscopy (n=52) or clinical follow-up (n=43) as reference standards, both Artoscan® 0.2 T and 1.5 T imaging showed high sensitivity (range 80–91%) in the detection of recurrent tears. Specificity and accuracy were not consistent across all situations. The presence of contrast medium within the meniscus substance on imaging showed higher specificity (84%, 42/50) and accuracy (84%, 80/95) with

the 0.2 T scanner than the 1.5 T scanner (specificity 74% (37/50), accuracy 81% (77/95)). Increased intrameniscal signal intensity had lower specificity (84%, 42/50) and accuracy (82% 78/95) on 0.2 T images than 1.5 T images (90% (45/50) and 88% (84/95), respectively).[2] The results indicate that the Esaote® 0.2 T system can achieve comparable specificity and accuracy to 1.5 T in identifying certain meniscal changes in a postoperative cohort.

Summary of safety evidence

We did not identify any studies directly comparing adverse events between Esaote® extremity MRI scanners (or any low-field MRI scanners) with conventional high-field MRI scanners in clinical populations. The safety evidence described below is largely descriptive and based on standard MRI safety guidance.

MRI is generally considered a safe imaging procedure when standard screening protocols are followed. Key considerations for safety include checking for the presence of ferromagnetic objects or implanted medical devices, which may move or heat dangerously in the magnetic field, or act as projectiles in the MRI suite.[10]

Low-field extremity MRI scanners may offer safety advantages. Reduced magnetic field strengths decrease projectile risks, lower acoustic noise and may allow safer imaging of patients with some metallic implants compared with high-field scanners.[12] In some cases, the use of lower doses or avoidance of contrast agents may be possible with low-field MRI, which can reduce toxicity risks for vulnerable groups.[12]

Summary of economic evidence

We did not identify any studies directly comparing the cost effectiveness of Esaote® extremity MRI scanners (or any low-field MRI scanners) with conventional high-field MRI scanners in clinical populations.

Several characteristics of Esaote® extremity MRI scanners may directly or indirectly influence their cost effectiveness and the anticipated budget impact of running an extremity MRI scanning service. In circumstances where it is possible to make an assumption of comparable diagnostic accuracy relative to high-field MRI scanners, extremity scanners are likely to have a much lower budget impact due to:

1. **Equipment cost:** the initial outlay cost of a 1.5 T MRI scanner is approximately £1.02 million (plus VAT). The exact purchase price of an Esaote® MRI machine is commercially sensitive, however both the O-scan smart extremity scanner and the Magnifico Open can be procured within the range of £200,000 to £550,000. This is significantly less than the cost of a 1.5 T scanner.
2. **Installation requirements:** Esaote® scanners are easier to accommodate within existing facilities without the need to build a standalone unit to provide sufficient floor area for a fixed high-field MRI scanner, thereby minimising expected capital construction costs associated with the introduction or expansion of an MRI service. These compact

scanners can be placed in modular units, community hospitals, general practice hubs or within upper floors of existing facilities.

3. **Operating costs:** Esaote® scanners have lower energy requirements and therefore lower running costs compared to a high-field MRI scanner. They do not require a three-phase power supply. The total kilowatt-hours of electrical power consumed by the O-scan smart (0.6kW while scanning) and the Magnifico Open (3kW at peak) are substantially lower than that of a 1.5 T MRI (20 kW at peak) even after accounting for low-field scanners running for longer to achieve the same exam yield as a conventional high-field scanner.

4. **Staffing Resource:** staff requirements will be largely site dependent based on local policies and procedures, however overall staffing resource needed for Esaote® scanners may be less than that required for a high-field MRI scanner. Minimum staffing complement for an Esaote® scanner is one person to report the scans (either a radiologist, advanced practice reporting radiographer, or a teleradiology service), and one person to perform the scans (a radiographer or assistant). A 1.5 T MRI scanner would require a minimum of two radiographers (Band 6 or 7) and scans could not be performed solely by assistant practitioners.

Indicative budget impact analysis

We developed a high-level budget impact analysis comparing the setup and operating costs of two types of Esaote® scanners versus a 1.5 T MRI scanner. The estimated purchase price of Esaote® scanners is commercially sensitive and cannot be published in this report. We have presented results in the form of a scenario analysis which covers a plausible range of purchase prices for Esaote® scanners.

Table 1 outlines the total setup and operating cost of the Esaote® scanners. The total includes the procurement cost as well as the expected annual revenue and staffing costs. The overall budget impact of introducing an Esaote® extremity scanner service is expected to be between £502,000 to £1.38 million contingent on the type and purchase price of Esaote® scanner.

Table 2 presents the estimated cost of bringing a new 1.5 T MRI scanner into service. Identical cost components were included when calculating the budget impact of Esaote® scanners at a specific purchase price.

Even at the highest listed purchase price, the total setup and operating costs for Esaote® scanners are substantially lower than those of a 1.5 T high-field scanner. Our analysis also excludes any site-specific costs associated with construction to house new MRI scanners, which for high-field scanners can be substantial.

Annual staffing costs for Esaote® scanners are expected to be lower compared to a 1.5 T MRI service. Estimates are outlined in Table 3 based on a routine five-day service week.

Our comparative budget impact analysis should be viewed alongside other needs of the service in terms of governance, safety, quality and transforming patient care as part of an options appraisal process.

Table 1: Scenario analysis of total cost of procuring Esaote® scanners

Purchase price	Esaote® O- Scan Smart	Esaote® Magnifico Open
(Scanner, equipment, upgrades, VAT)	*Total setup + operating costs*	
£200,000	£502,483	N/A
£250,000	£571,316	N/A
£300,000	£640,149	N/A
£450,000	N/A	£906,280
£500,000	N/A	£975,113
£550,000	N/A	£1,043,946

Table 2: Total procurement and operating costs of high-field MRI

	1.5T high-field MRI
	All routine MRI examinations
MRI scanner	£1,021,608
VAT @ 20%	£204,322
Additional equipment purchases & upgrades	£50,000
Additional prof fees (Hyrdo, xBuro)	£7,500
Total initial outlay	*£1,283,430*
Annual revenue costs	
Depreciation	£180,478
Service contract & consumables	£100,000
Electricity & estates	£72,000
Picture archiving and communication system (PACS) cost	£10,000
Staffing costs	£334,031
Total annual revenue costs	*£696,509*
Total cost	**£1,979,939**

Table 3: Comparative annual staffing costs for MRI scanners

Staff resource	Esaote® O- Scan Smart	Esaote® Magnifico Open	1.5T high-field MRI
Consultant Radiologist	£39,614	£39,614	£39,614
Radiographer (Band 7)	£34,583 (0.5WTE)	£34,583 (0.5WTE)	£69,165
Radiographer (Band 6)	-	£30,832 (0.5 WTE)	£92,495 (1.5 WTE)
Medical Physics (Band 8A)	£16,286 (0.2WTE)	£16,286 (0.2 WTE)	£57,002 (0.7 WTE)
Radiography Assistant	£34,434	£34,434	£41,321 (1.2 WTE)
Admin Assistant	£34,434	£34,434	£34,434
Total staff cost	**£159,351**	**£190,183**	**£334,031**

**Whole time equivalent (WTE) assumed to be 1.0 unless specified*

Patient or user experience

We did not find any studies that evaluated patient experience with Esaote® extremity MRI scanners.

A 2022 prospective study demonstrated significant patient-perceived benefits with a 0.55 T low-field MRI scanner (MAGNETOM FreeMax, Siemens) compared with a conventional 1.5 T scanner.[8] Patient comfort was assessed in 50 patients who underwent consecutive MRI examinations on both scanners using matched imaging protocols. The 0.55 T scanner had a wider bore (80 cm versus 60 cm) and produced lower maximum noise levels (mean ± standard deviation) compared with the 1.5 T scanner (brain MRI: 83.8 ± 3.6 decibels (dB) versus 89.3 ± 5.4 dB; p=0.04). Patient-reported outcomes improved for the low-field scanner: 84% rated the sense of space as 'better' or 'much better', 84% reported lower noise and 78% rated overall examination comfort as superior to the 1.5 T scanner. The authors concluded that patients found the 0.55 T low-field MRI scanner more comfortable than the conventional 1.5 T MRI, because of its wider bore and lower noise levels during scanning. The study sample was small and might have been affected by selection bias, as claustrophobic patients may have declined participation in the second scan with the conventional 1.5 T scanner.[8]

Further studies are needed to evaluate the impact of low-field MRI on patient-reported outcomes, anxiety and procedural success across broader populations.

Conclusions

The available evidence on the diagnostic performance, safety and patient experience of modern Esaote® MRI extremity scanners system for patients with MSK conditions is limited. We identified two primary studies using Esaote® scanners. The evidence suggests that low-field MRI should not be regarded as a replacement for established high-field scanners but rather considered as an extension of the existing imaging protocols. Their potential advantages (improved patient comfort, lower artefact susceptibility and portability) support their consideration as a complementary tool for selected imaging.

Patient and user experience may be a key benefit from using modern low-field MRI. Wider bore diameters, reduced gradient-related acoustic noise and flexible coil designs improve patient comfort, tolerability and potentially completion rates, particularly in claustrophobic or anxious individuals. These benefits may reduce the need for sedation, improve patient acceptance and expand accessibility of MRI examinations.

Robust peer-reviewed, diagnostic accuracy studies using newer Esaote® technology in relevant MSK patient populations are required to demonstrate comparative efficacy compared with 1.5 T and 3 T MRI scanners.

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What is an IMTO?

An Innovative Medical Technology Overview (IMTO) provides a high-level summary of health and care innovations. IMTOs include a description of the technology and its potential use in Scotland, and an overview of the evidence to help gauge the potential impact of the technology on people and health and care services.

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Appendix 1: Abbreviations

AHP	Allied Health Professional
AI	artificial intelligence
dB	Decibels
IMTO	Innovative Medical Technology Overview
MRI	magnetic resonance imaging
MSK	Musculoskeletal
N/A	not applicable
NHS	National Health Service
PACS	picture archiving and communication system
RF	Radiofrequency
SHTG	Scottish Health Technologies Group
T	Tesla
WTE	whole time equivalent

Appendix 2: Definitions of diagnostic accuracy terms

Sensitivity: the probability that a person having a disease will be correctly identified by a clinical test, that is the number of true positive results divided by the total number with the disease.[17]

Specificity: the probability that a person not having a disease will be correctly identified by a clinical test, that is the number of true negative results divided by the total number of those without the disease.[17]