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www.philips.com/compressedsense

healthcare@philips.com



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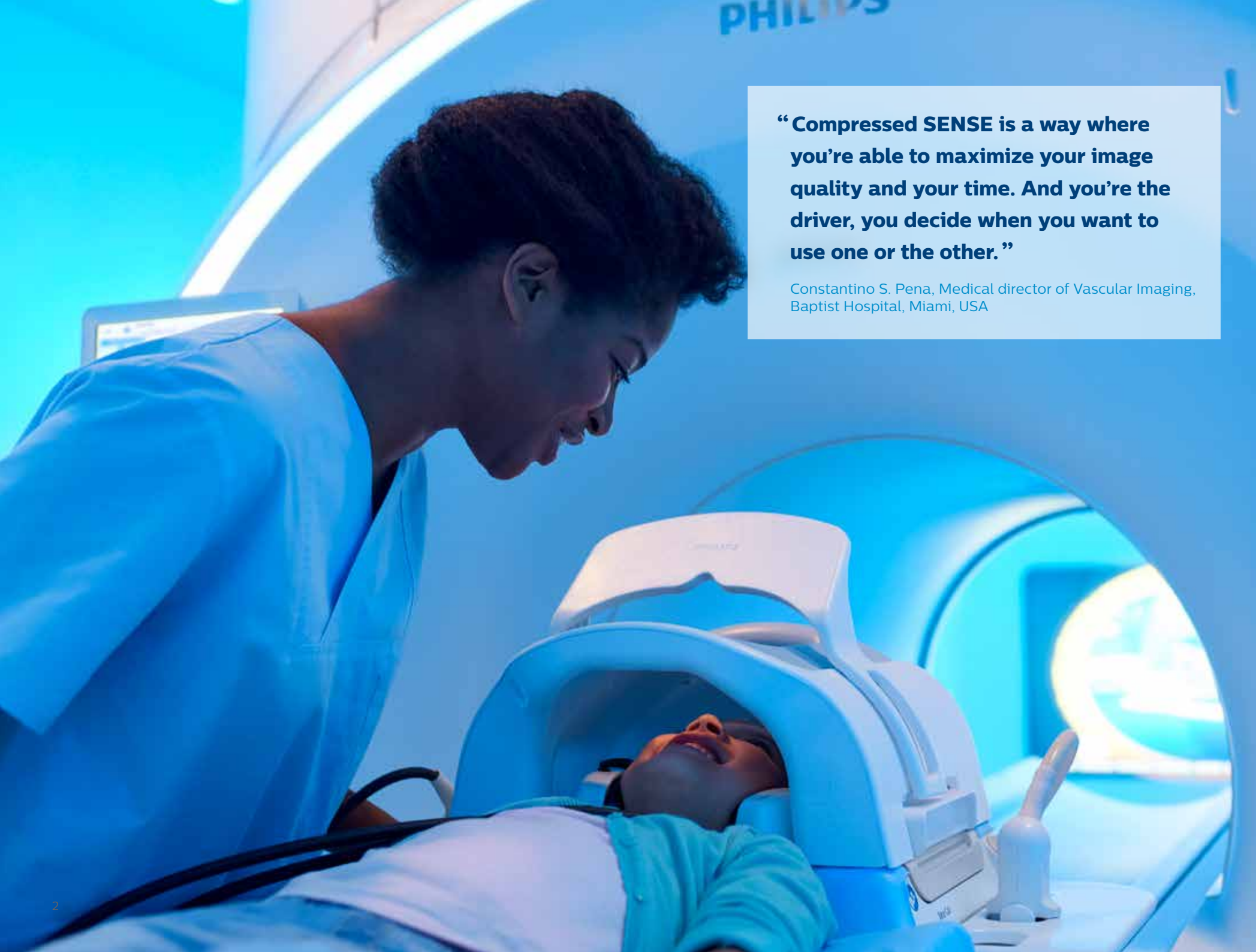
Compressed SENSE

MR Clinical application

Up to 50% faster MR exams,
so you can spend your time wisely¹

Boost your MRI productivity with Philips Compressed SENSE

¹ Compared to Philips scans without Compressed SENSE



“Compressed SENSE is a way where you’re able to maximize your image quality and your time. And you’re the driver, you decide when you want to use one or the other.”

Constantino S. Pena, Medical director of Vascular Imaging,
Baptist Hospital, Miami, USA

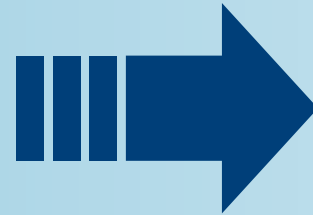
Spend your MR time more wisely with Philips Compressed SENSE

Time is one of the most precious commodities you have in your MR department. What if we told you there was a way to recover time you have been losing during your MR examinations? And use the time you do have more wisely? Imagine how that could help you make better use of your scarce resources and better meet the demands of referring physicians. That’s exactly what Philips Compressed SENSE can do for your MR department. It accelerates your existing MR scans by up to 50%, frees up time to improve your patient experience and can provide up to 60% higher resolution to enhance diagnostic confidence.¹

Philips Compressed SENSE is suitable for all anatomies and can be used for all anatomical contrasts, in both 2D and 3D.

¹ Compared to Philips scans without Compressed SENSE.

Benefits of Compressed SENSE



Speed

Up to 50% faster MRI exams
with virtually equal image quality¹



More patients



Flexible patient
scheduling



Reduce overtime



Comfort

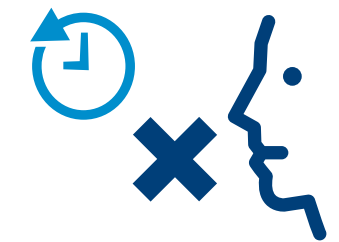
More time for your patients
Increase patient satisfaction



More time
with patient



Reduced SAR

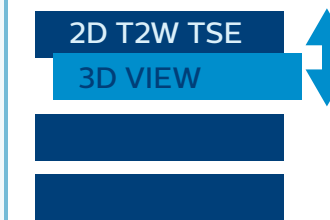


Reduced time
breath hold



Confidence

Higher spatial resolution
within the same scan time



Replace sequences

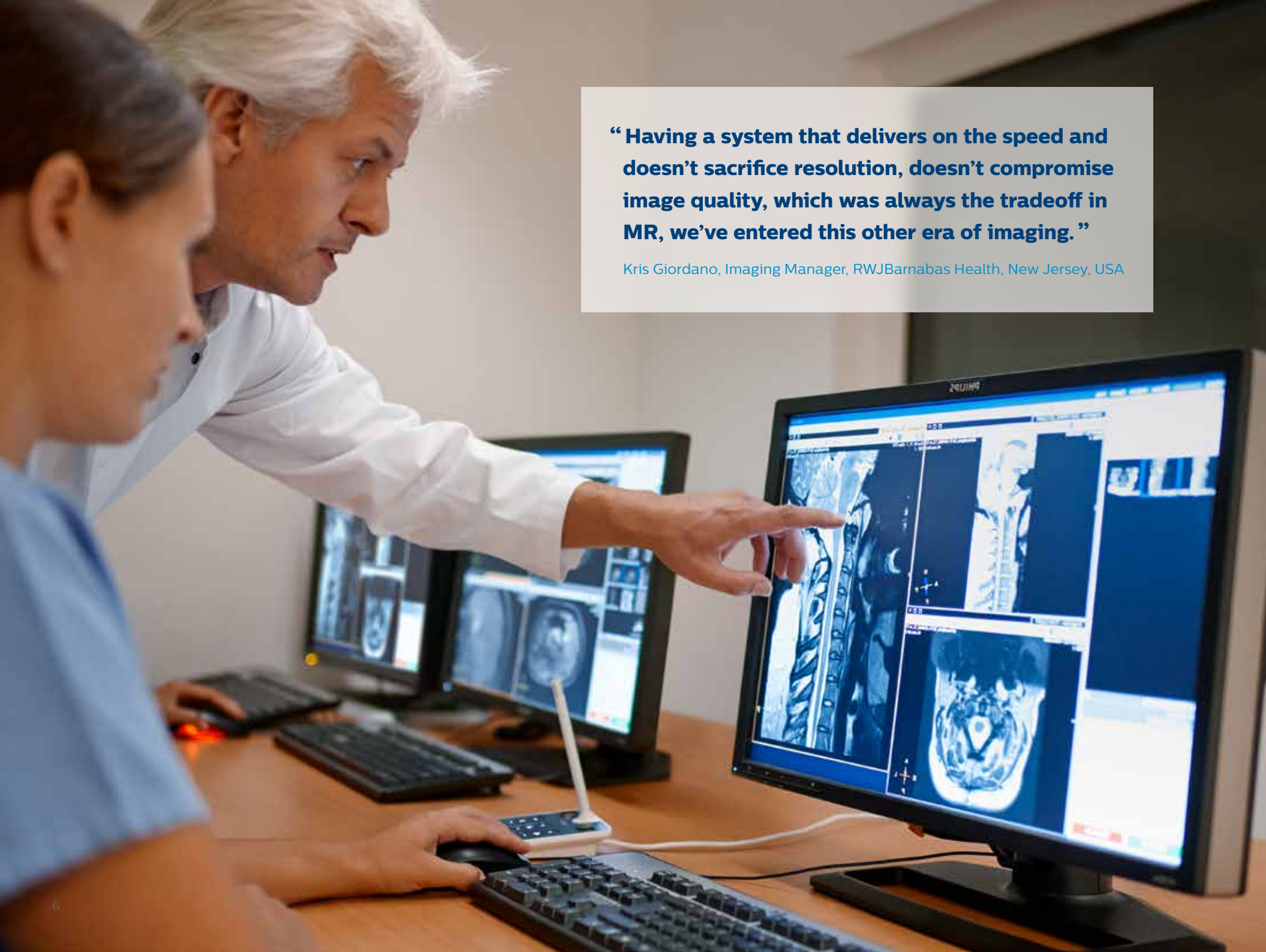


Improve resolution



Add sequences

¹ Compared to Philips scans without Compressed SENSE.

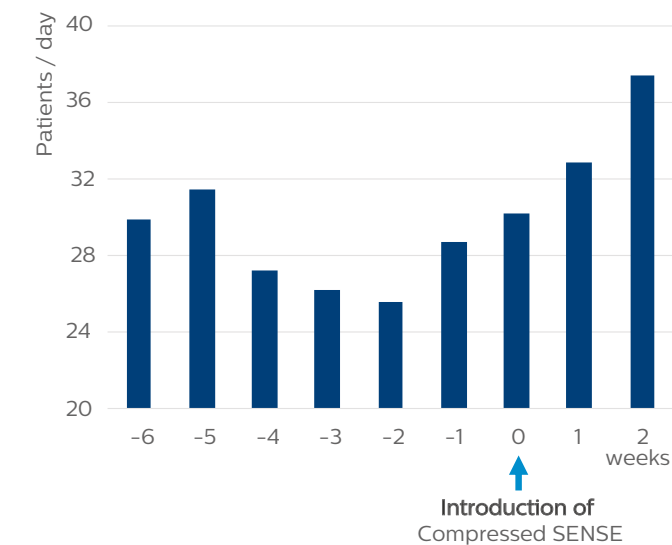


“Having a system that delivers on the speed and doesn’t sacrifice resolution, doesn’t compromise image quality, which was always the tradeoff in MR, we’ve entered this other era of imaging.”

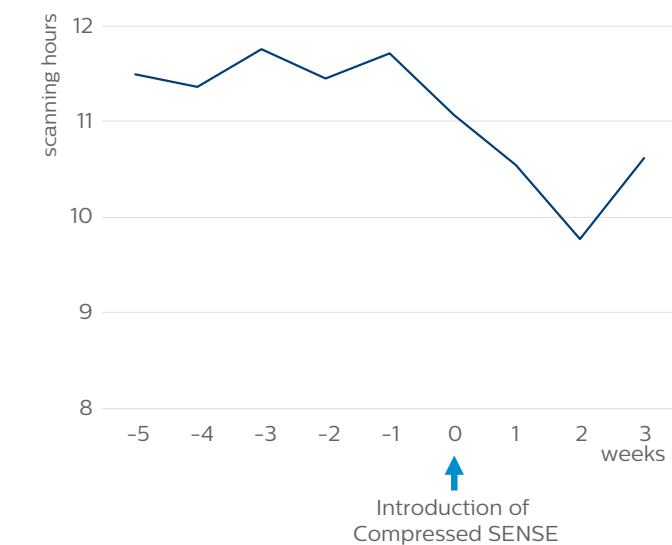
Kris Giordano, Imaging Manager, RWJBarnabas Health, New Jersey, USA

Up to 50% faster MRI exams with virtually equal image quality¹

If your MR department has reached its maximum capacity of exams or struggles with a continuous backlog of patients, Compressed SENSE can give you extra time to address these issues. You can use Compressed SENSE to scan patients up to 50% faster, with virtually equal image quality.¹ There are many ways you can put the time you save to good use to address your capacity, scheduling and waitlist issues.



Radiologie Dr Wagner in Gottingen, Germany can accommodate >5 more patients per day¹, within the same scanning hours, after the introduction of Compressed SENSE.



ComputerTomography Institut in Innsbruck, Austria has been able to reduce overtime by more than one hour, keeping the same patient throughput per day, after the introduction of Compressed SENSE.

¹ Compared to Philips scans without Compressed SENSE. Results from case studies are not predictive of results in other cases. Results in other cases may vary.

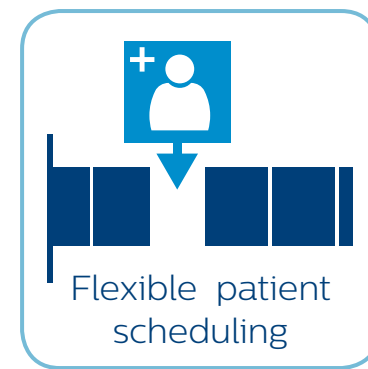


Increase productivity

Many hospitals are looking for ways to increase the utilization of their MR equipment to meet the rising demand for MRI services. A full MRI exam performed with Compressed SENSE, for example, can save minutes compared to a conventional MRI exam ,as shown on previous page. This could free up one or two extra exam slots in your daily schedule, which can result in much higher productivity and shorter waitlists without adding more operator hours.

“We went from hour time slots to 30 minutes. We went from having 13 patients to 26 to 28 every single day.”

Kris Giordano, Imaging Manager, RWJBarnabas Health, New Jersey, USA



Reduce scheduling hassles

Do unscheduled patients disrupt your daily schedule and put extra stress on your staff? With Compressed SENSE you can create a buffer to easily handle emergency cases or urgent patients that are referred on the same day. This extra capacity can help you serve patients and referring physicians faster and make daily workflow go smoother for staff.

“We can now provide a more flexible and faster MRI service to our patients and referring physicians. We still perform as many sequences as before we had Compressed SENSE - it’s just much faster now.”

Hideki Koyasu, M.D., Koyasu Neurosurgery Clinic, Kanagawa, Japan



Increase staff satisfaction

Having to work overtime is a recurring issue for many MRI departments that can impact staff satisfaction and run-up operational costs. The stress caused by heavy workloads and overtime hours greatly contribute to burnout among radiology technologists, not to mention long-term mental and physical health issues¹. By reducing MRI scan times and improving scheduling flexibility, Compressed SENSE helps patients and staff to get home on time. This can improve the experience for all involved.

“The shorter exams alleviate the pressure on our full daily schedule of MRI patients. And on top of that we also manage to reduce overtime.”

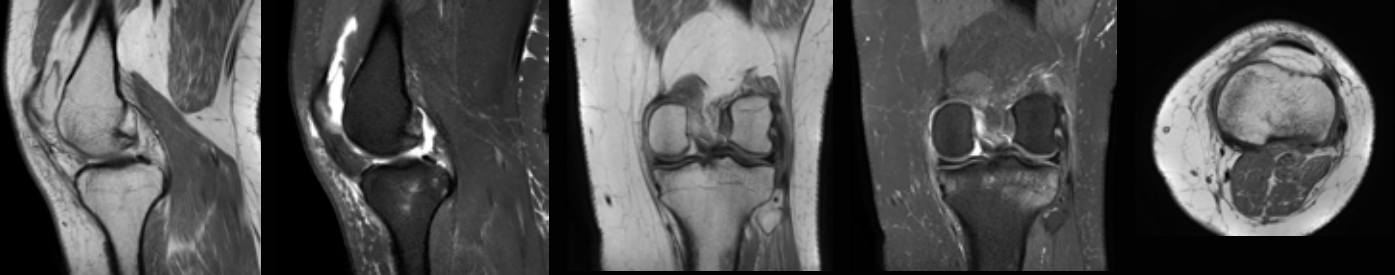
Katsuhiro Shiba, R.T., Koyasu Neurosurgery Clinic, Kanagawa, Japan

Reduce the overall examination time in 2D sequences
without losing image quality¹

Without
Compressed SENSE



With
Compressed SENSE



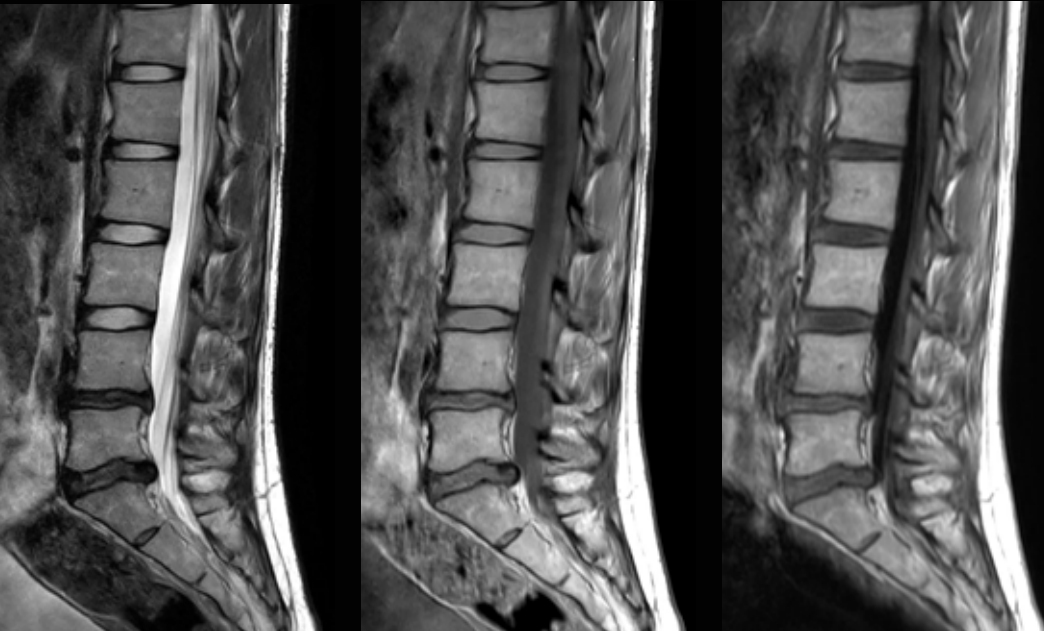
Sagittal PDw aTSE	Sagittal T2w SPAIR	Coronal PDw aTSE	Coronal PDw SPAIR	Axial T1w TSE	Axial PDw SPAIR
0.3 x 0.4 x 3.0 mm	0.4 x 0.5 x 3.0 mm	0.3 x 0.4 x 3.0 mm	0.4 x 0.5 x 3.0 mm	0.3 x 0.4 x 3.0 mm	0.4 x 0.5 x 3.0 mm
2:54 min / 2:10 min	5:31 min / 4:38 min	2:44 min / 1:56 min	4:35 min / 3:35 min	3:05 min / 2:33 min	3:49 min / 3:12 min

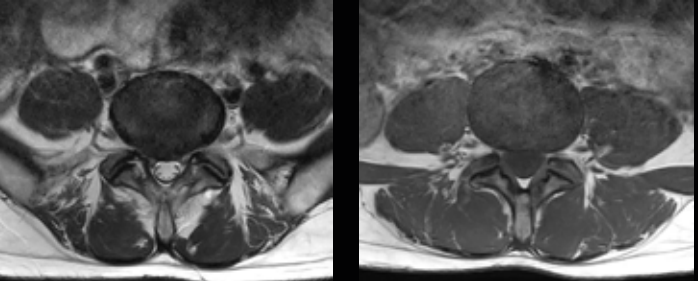
University of Vermont Medical Center, Burlington, USA, Ingenia 1.5T.
Results from case studies are not predictive of results in other cases. Results in other cases may vary.
¹ Compared to Philips scans without Compressed SENSE.

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more information on
this clinical case.



Shorter scan slots, possibly allowing for more patients per day
Perform a lumbar spine in less then 10 minutes total exam time



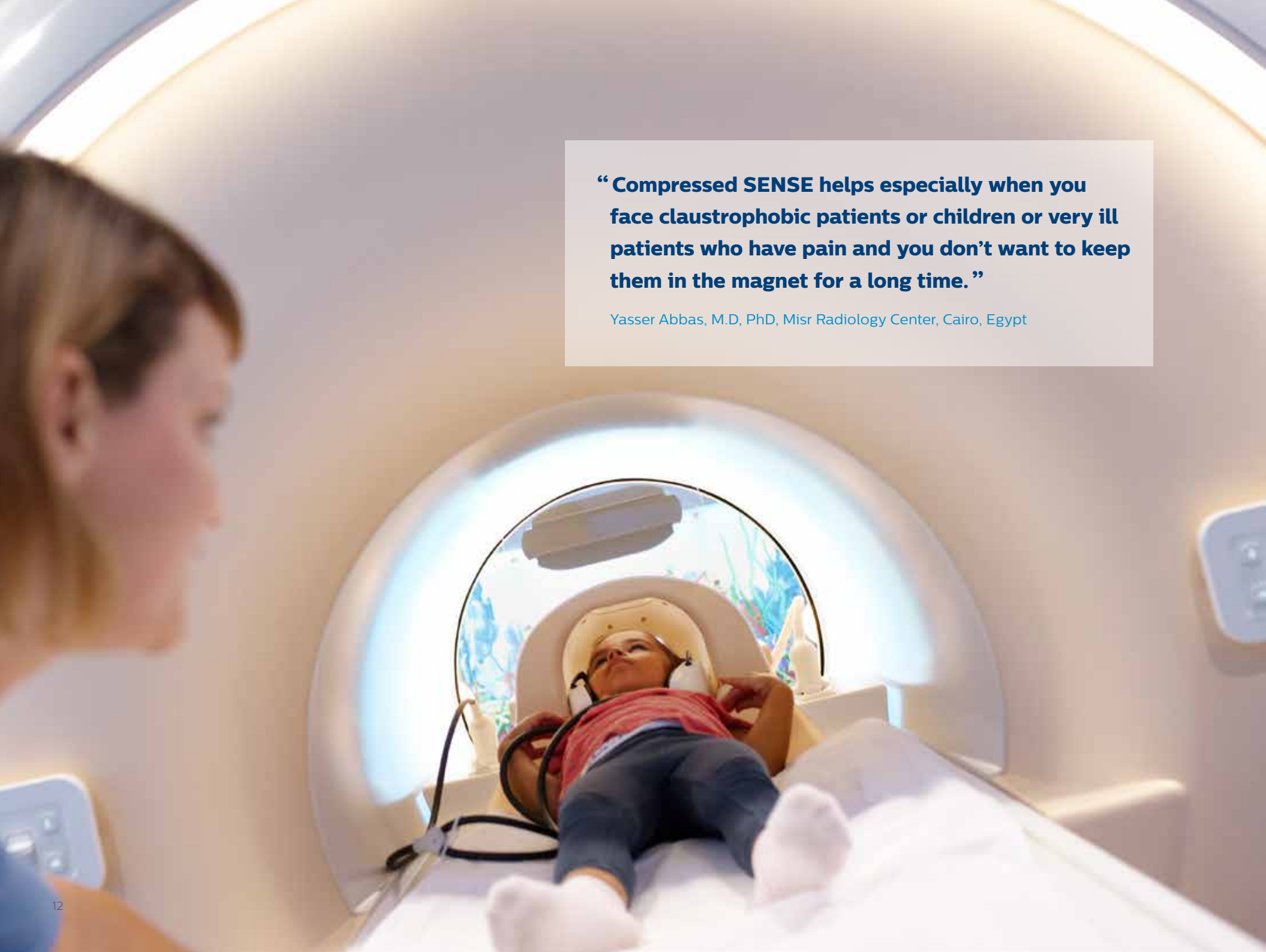


Sagittal T2w TSE	Sagittal PDw TSE	Sagittal T1w FLAIR	Axial T2w TSE	Axial T1w TSE
0.7 x 0.9 x 4.0 mm	0.7 x 1.0 x 4.0 mm	1.0 x 1.4 x 4.0 mm	0.6 x 0.7 x 4.0 mm	0.6 x 0.7 x 4.0 mm
1:30 min	1:30 min	3:24 min	1:33 min	1:23 min

Lenox Hill Radiology, Flushing, New York, USA, Ingenia Elition 3.0T
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

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more information on
this clinical case.





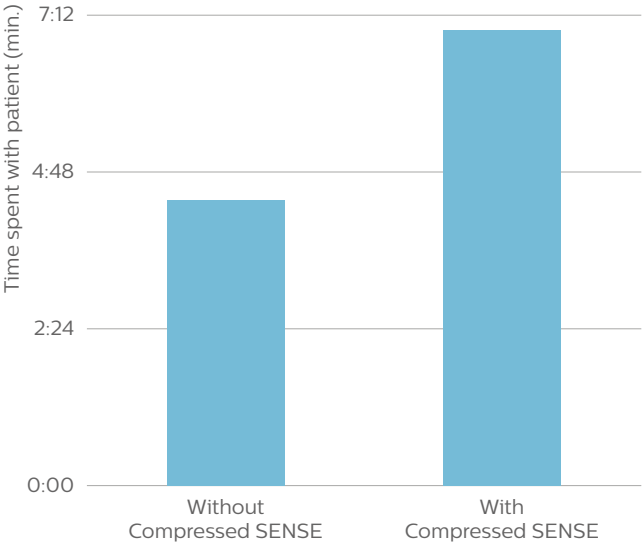
“Compressed SENSE helps especially when you face claustrophobic patients or children or very ill patients who have pain and you don’t want to keep them in the magnet for a long time.”

Yasser Abbas, M.D, PhD, Misr Radiology Center, Cairo, Egypt

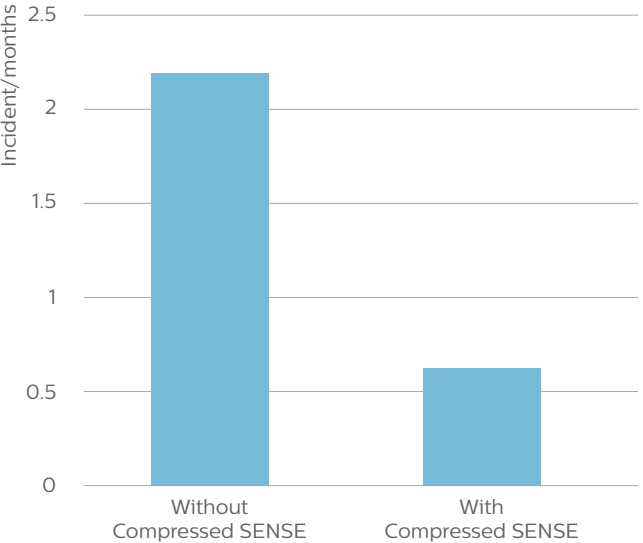
More time for your patients

Increase patient satisfaction

Do you think extra preparation time could help patients relax and better comply with MRI exams? Compressed SENSE improves patient comfort in many ways. It shortens their time on the table and their breath holds. Reducing the overall exam time also gives staff more time to prepare and guide patients so they have a more positive experience.



After the introduction of Compressed SENSE, Kurashiki Central Hospital in Okayama, Japan, was able to increase the time spent with patients during set-up by 67% on average.



As a result, Kurashiki Central Hospital in Okayama, Japan managed to decrease incidents/errors by 70% on average, after the introduction of Compressed SENSE.

Results from case studies are not predictive of results in other cases. Results in other cases may vary.



Accept challenging patients

Is your daily schedule disrupted by the long scan times required to scan patients with MR conditional implants or high BMI? It can be challenging to scan these patients because of the specified SAR levels required. By integrating Compressed SENSE into your ExamCard, you can reduce your total MRI exam time whilst keeping the SAR levels within the limits as specified by the MR Conditional implant manufacturer.

“Patients with MR Conditional implants have a limited amount of scan time. And with Compressed SENSE, we’re able to complete more of the protocol or sometimes even the entire protocol.”

Mark Oswood, M.D., PhD, Hennepin County Medical Center, Minneapolis, USA

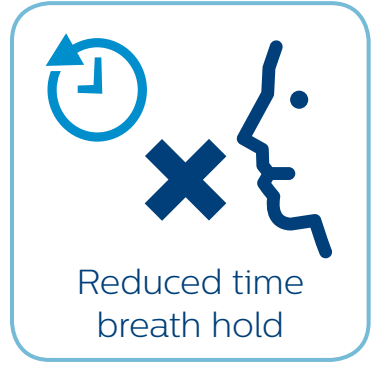


Extra time and attention for patients

Most patients approach their MRI exam with a certain level of apprehension or fear of closed spaces that can cause delays and poor results. Compressed SENSE shortens MRI scan times, so your staff can give patients extra attention and reassurance. They can explain what to expect and how to comply with the instructions they receive. This extra personal attention can promote a positive scanning experience, which can build your reputation as a patient-friendly MRI provider.

“Due to the shorter scan times achieved with Compressed SENSE, technologists can spend the gained time on increasing the image quality, or to take more time for patient preparation and dealing with safety aspects.”

Masayuki Kumashiro, M.D., PhD, Kurashiki Central Hospital, Okayama, Japan



Shorter breath holds

If many of your patients have difficulty holding their breath during an MRI exam, it can have a big impact on your failure and re-take rates. That can have a knock-on effect across your entire schedule. Compressed SENSE can reduce breath hold times by up to 40%, with virtually equal image quality.¹ Hospitals that have implemented Compressed SENSE report a better patient experience thanks to shorter breath holds.

“A 15- or 16-second breath-hold is tough for many cardiac patients. With Compressed SENSE we actually have protocols now that can get that below 10 seconds. It’s a lot easier to get through for a patient, and patients are a lot more satisfied with the experience.”

Trevor Andrews, Ph.D., MR Physicist, University of Vermont Medical Center, Burlington, USA

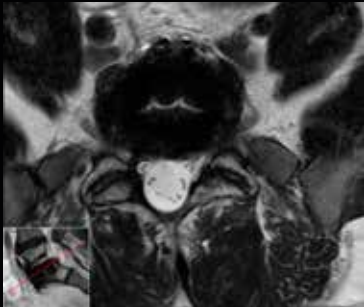
¹ Compared to Philips scans without Compressed SENSE.

Shorten exam times for low SAR sequences

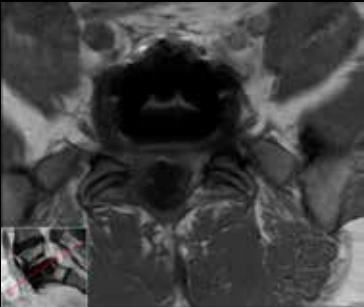
Confidently scan patients with MR Conditional implants



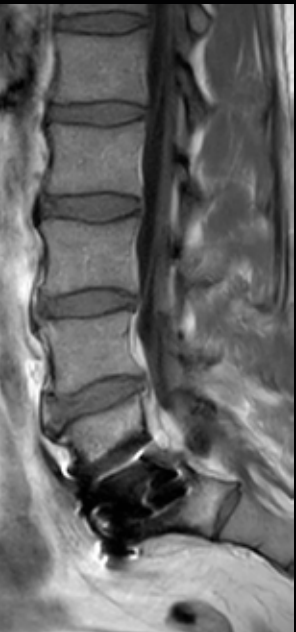
Sagittal T2w TSE
0.8 x 0.9 x 4.0 mm
5:28 min



Axial T2w TSE
0.6 x 0.9 x 4.0 mm
7:11 min



Axial T1w TSE
0.9 x 1.0 x 4.0 mm
4:44 min



Sagittal T1w TSE
(post gado)
0.9 x 1.0 x 4.0 mm
5:33 min



Axial T1w TSE (post-gado)
0.9 x 1.0 x 4.0 mm
4:44 min

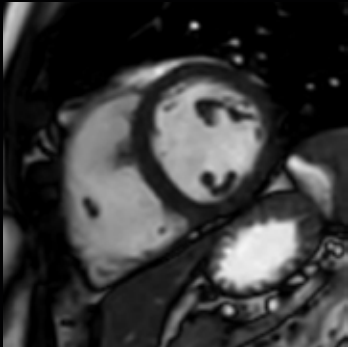
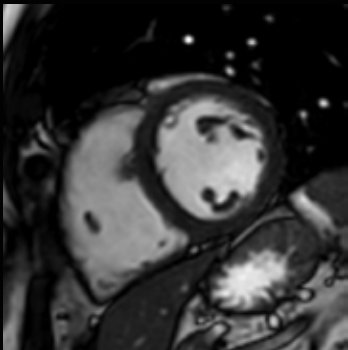
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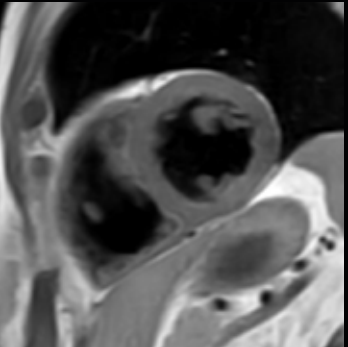
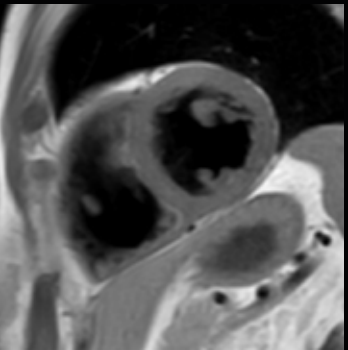
Reduced breath holds

Improve patient experience¹

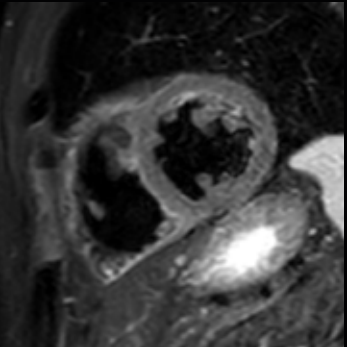
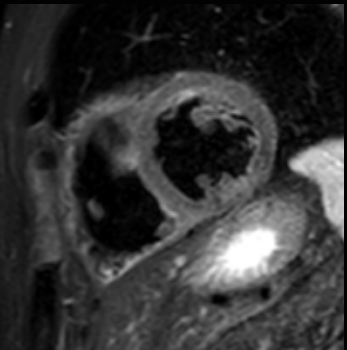
Without
Compressed SENSE



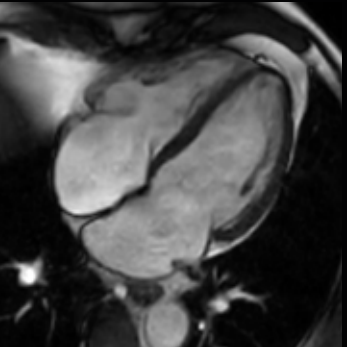
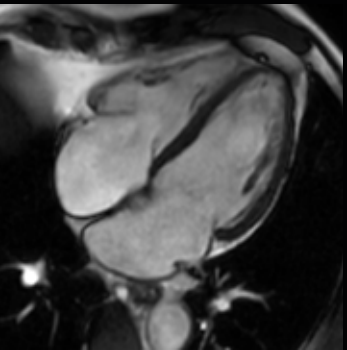
bTFE short axis
1.7 x 1.9 x 8.0 mm
8.4 sec / 4.8 sec



T1w TSE Black Blood
1.4 x 1.7 x 8.0 mm
15.6 sec / 10.8 sec



T2w STIR Black Blood
1.4 x 1.8 x 8.0 mm
14.4 sec / 9.6 sec



bTFE 4 chamber
1.7 x 1.8 x 8.0 mm
7.2 sec / 4.8 sec

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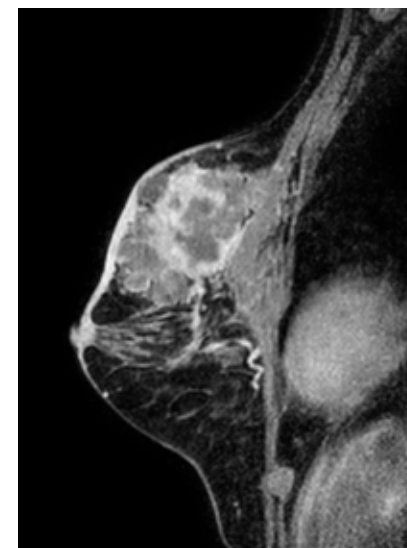


“Seeing more tiny details, for instance with 3D, helps us in making confident diagnoses.”

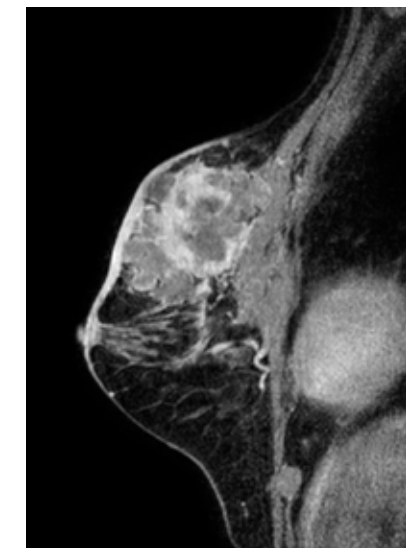
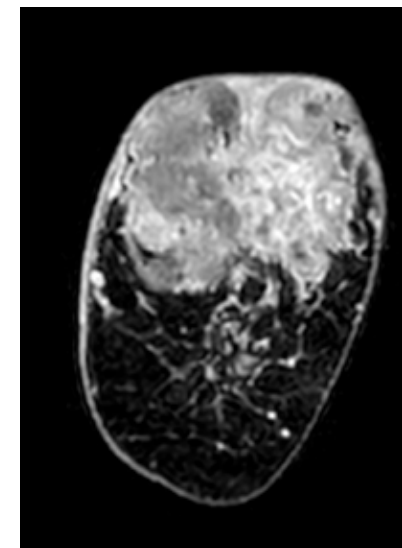
Sabine Sartoretti, M.D., Kantonsspital Winterthur, Switzerland

Higher spatial resolution within the same scan time

Are the constraints of your current MRI scanning techniques holding you back from offering more advanced scans to your referral base? Instead of faster scans, you can use the power of Compressed SENSE to enhance your diagnostic confidence in the same time slot, or to add extra techniques to enhance insight, or to perform 3D scans to see more details. Imagine how this imaging flexibility could help you unlock new revenue streams for your MR department.



3D mDIXON XD
1.0 x 1.0 x 0.5 mm, 2:22 min.



3D mDIXON XD with Compressed SENSE
0.8 x 0.8 x 0.4 mm, 2:21 min.
Improved spatial resolution in the same scan time

Kurashiki Central Hospital, Okayama, Japan. Ingenia 1.5T.
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

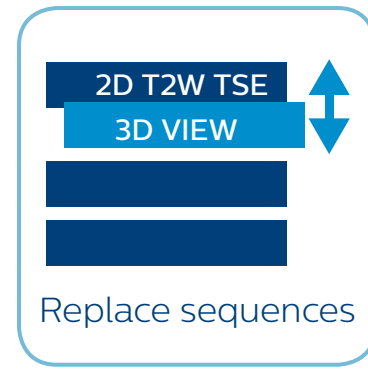


Improve resolution for challenging anatomies

Do your current time slots give you the flexibility to perform a higher resolution scan when dealing with an advanced clinical question? Obtaining high resolution scans can be very time-consuming, so they are difficult to accommodate in a busy department. Patients who are seriously ill or experiencing pain may also have trouble completing these long scans. In fact, Compressed SENSE enables up to 64% improvement in spatial resolution, within the same scan time.¹

“In breast scanning, high resolution is important to help me identify very small mammary lesions. Compressed SENSE has allowed us to increase spatial resolution, which benefits our diagnostic confidence.”

Takashi Koyama, M.D., PhD, Kurashiki Central Hospital, Okayama, Japan



Create space for more powerful sequences

Thanks to the diversity of 2D and 3D MRI techniques, you can obtain a wealth of information about each individual case if you just have enough time. Compressed SENSE can give you the time and critical details you need to make confident decisions. For example, to obtain high spatial resolution of tiny nerves and vessels for brain and spine examinations, you can now replace 2D MRI scan sequences with faster 3D sequences.

“We used to do 2D scans and then you are bound to the imaging plane that was acquired. Now we do 3D imaging of the pelvis, isotropic imaging, and this then enables offline reform adding at any angle that you wish for, so this really helps.”

Rickmer Braren, M.D., Technical University of Munich, Germany



Provide more information to your referrals

Giving your referring physicians as much as information as they want or need is the key to building preference for your MRI services. By reducing scan times dramatically, Compressed SENSE gives you room to add extra routine and functional sequences to deepen diagnostic confidence. That means you can say yes to a request for a specific scan or can do more scans than specified, without increasing the available scan slot.

“Because the faster scanning with Compressed SENSE saves us time, we can sometimes add a sequence to obtain high quality spine images in the same time slot for confident diagnoses.”

Sachi Fukushima, R.T., Kurashiki Central Hospital, Okayama, Japan

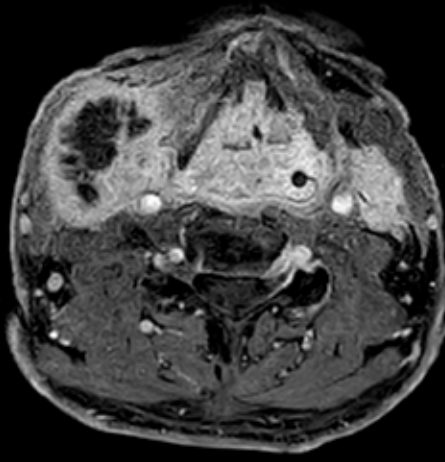
¹ Compared to Philips scans without Compressed SENSE.

High spatial resolution

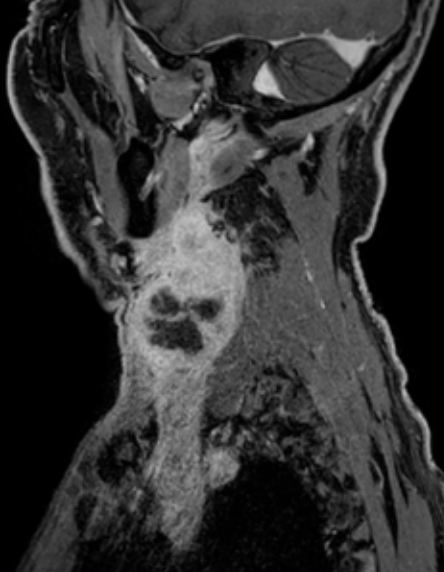
within short scan times



Axial T2w TSE
0.6 x 0.8 x 5.0 mm
1:01 min



Axial T1w mDIXON XD (post-gado)
0.7 x 0.7 x 0.5 mm
1:38 min



Sagittal T1w mDIXON XD (post-gado)
0.8 x 0.7 x 0.5 mm
1:22 min

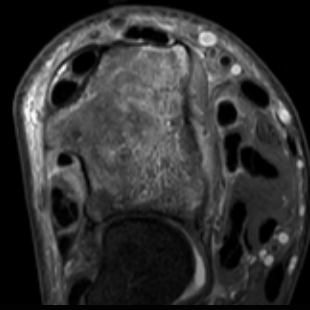
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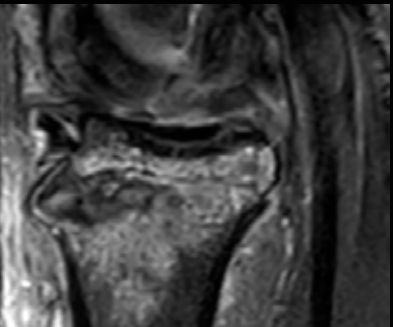
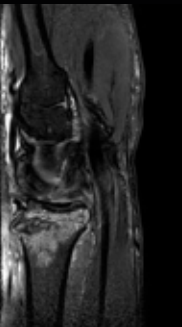
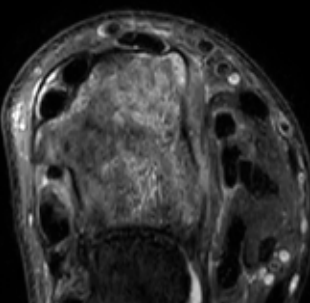
Shorter scan times for 3D sequences

Potentially replacing 2D sequences

2D
2.0 mm slices



3D
0.5 mm slices



Coronal PDw SPAIR
0.3 x 0.4 mm
3:32 min / 3:40 min

Axial PDw SPAIR
0.3 x 0.5 mm
2:39 min / 3:28 min

Sagittal PDw SPAIR
0.3 x 0.4 mm
3:44 min / 3:38 min

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Kumamoto Chuo Hospital, Japan. Achieva dStream 1.5T.
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Radiologie am St Josef Stift, Bremen, Germany. Ingenia 1.5T.
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Compressed SENSE is compatible with multiple generations Philips MRI systems



Ingenia Ambition
Ingenia Elition



Ingenia Prodiva¹



Ingenia



Ingenia CX
Achieva dStream



Achieva



Intera²

“With Compressed SENSE you get a very similar result with a significant reduction in scan time with remarkable consistency.”

John P. Karis, M.D., Barrow Neurological Institute, Phoenix, USA

¹ Ingenia Prodiva is not for sale in the USA.

² Compressed SENSE is not available for all Intera systems, please contact your local sales representative for further information.

How Compressed SENSE makes an MRI scan up to 50% faster¹

Compressed sensing is a term from the field of digital signal processing. When a signal is digitally sampled, like it happens in an MRI scanner, the signal is not recorded continuously (like old cassette players used to do) but at intervals.

A famous theorem from digital signal analysis, the Nyquist theorem, states that for constructing a perfect MR image of 256 x 256 pixels, it is required to sample 256 lines in k-space, each sampled in 256 positions. By doing less, the acquisition will be faster, but the reconstructed image will always be distorted one way or another.

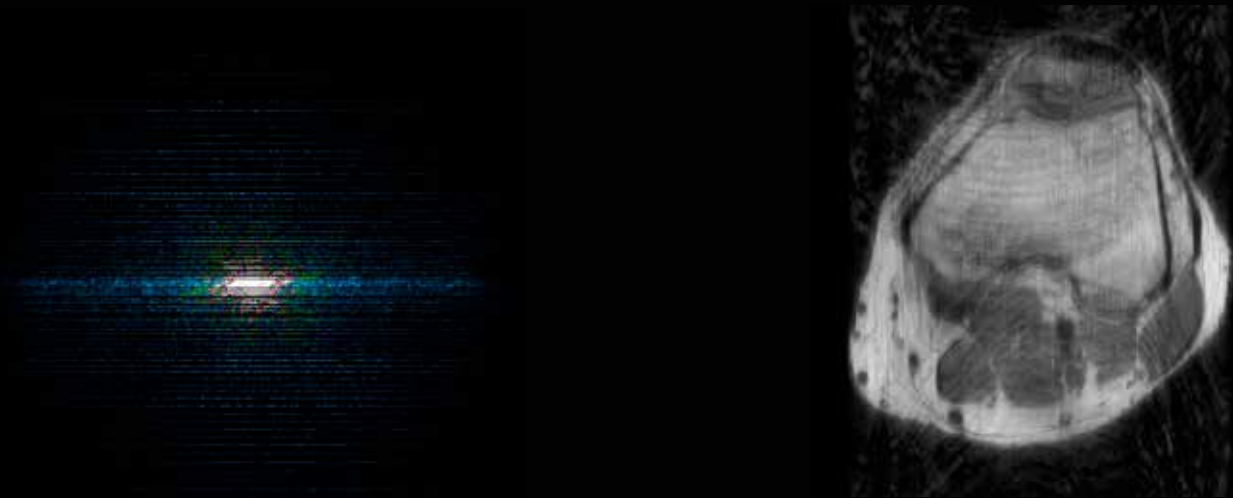
This is exactly what happens with traditional acceleration techniques in MRI, such as halfscan, radial, spiral, increased voxel size and parallel imaging. All of these methods skip parts of k-space during acquisition in order to reduce acquisition time. However, there will always be a penalty: either a reduced signal-to-noise ratio (halfscan, parallel imaging), lower image resolution (increased voxel size) or image artifacts (spiral, radial).

Compressed SENSE is not different, but in practice it is often more forgiving than other acceleration techniques in terms of image distortion and SNR, because it can be designed to primarily sample the MR signals that matter most, while leaving out the rest.

A unique aspect about compressed SENSE is that it can bypass the aforementioned Nyquist theorem: although not enough samples are taken for perfect image reconstruction, a good compressed SENSE reconstruction can successfully remove the inherent artifacts and produce excellent diagnostic images.



Scan the QR code for more details on how Compressed SENSE works.



Standard reconstruction. Sub-sampled k-space and inherent image artifacts



Compressed SENSE reconstruction. Iterative, knowledge-based algorithms to fill in the empty lines in k-space. This removes the image artifacts while keeping the final image fully consistent with the acquired data.