

# FieldStrength

Publication for the  
Philips MRI Community

**ISSUE 49 – 2013 / 2**

## Changing MRI methods in head and neck imaging

mDIXON TSE, Diffusion TSE address MRI challenges in the head/neck area  
and allow different imaging strategies.



This article is part of  
**FieldStrength issue 49 - 2013/2**

Read more articles  
or subscribe to FieldStrength on  
[www.philips.com/fieldstrength](http://www.philips.com/fieldstrength)

Results from case studies are not predictive of results in other cases. Results in other cases may vary. Results obtained by facilities described in this issue may not be typical for all facilities. Images that are not part of User experiences articles and that are not labeled otherwise are created by Philips.



**Berit Verbist, MD, PhD**, became certified radiologist at the Catholic University of Leuven, Belgium. She is senior staff member in head/neck radiology and neuroradiology at Leiden University Medical Centre and Radboud University Nijmegen Medical Centre. In 2003 she spent visiting fellowships in Head and Neck radiology at the University of Florida, Gainesville, USA and Oregon Health and Science University, Portland, USA. She is board member of the ESHNR.

*“These techniques simply provide better images with fewer artifacts.”*

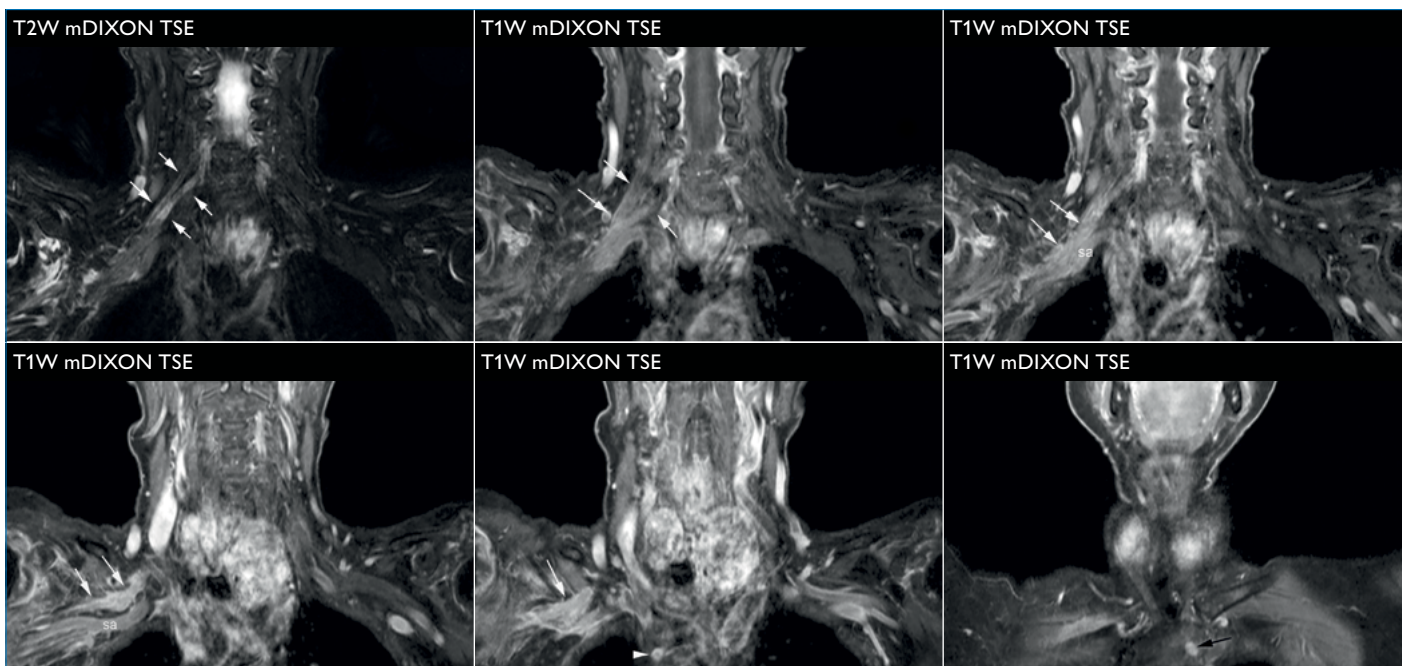
# Changing MRI methods in head and neck imaging

mDIXON TSE, Diffusion TSE address MRI challenges in the head/neck area and allow different imaging strategies.

Robust head and neck imaging is becoming routine at [Leiden University Medical Center](#) (Leiden, The Netherlands) thanks to new techniques that provide better fat suppression and shorter scan times. Large-coverage, fat-free imaging is now a reality in imaging skull-base lesions, in otology, and in imaging of the orbit and nerves.

Berit M. Verbist, MD, PhD, points out the challenges of obtaining good image quality in head and neck images. “We need very detailed images from a complex anatomical area, and the area is prone to movement artifacts so we need short acquisition times. We also need to minimize the number of sequences because it gets tiring for the patient if it takes too long. Another big problem is susceptibility artifacts, because of the boundaries between air, bone and tissue, and because many patients have undergone complex surgical procedures that include osteosynthetic materials, which leads to more artifacts and inhomogeneous fat suppression. There is also an interest in scanning with a large field of view, mainly for the lower neck and thoracic inlet.”

To overcome these challenges, Dr. Verbist is using mDIXON TSE (turbo spin echo) on the Ingenia 3.0T with the dS HeadNeckSpine coil. The mDIXON technique provides four images in one acquisition: water images (fat suppressed), in-phase images (without fat suppression), out-of-phase images and fat images. “mDIXON TSE delivers very homogeneous fat suppression, even when we use a large field of view. It addresses the problems with distortion due to susceptibility and it allows us to use large fields of view. I’ve applied it in



#### mDIXON TSE in a patient with brachial plexopathy

An 88-year-old female presented with painful progressive paralysis of the right arm. She had a history of breast carcinoma on the right 6 years earlier, which was treated with mastectomy. Five years ago she underwent radiotherapy for a local recurrence. In the right brachial plexus. MR images show thickening and high intensity in cervical roots C5, C6 and C7 extending to the lateral and posterior cords (white arrows). A parasternal lymph node (arrow head) and a lesion in the sternum (black arrow) are also noted. Note also an enlarged multinodular thyroid gland. (sa: subclavian artery).

The mDIXON TSE images provide homogeneous fat suppression in a large field of view, even in areas with air-bone-soft tissue interfaces. This delivers good visualization of the lower neck region and thoracic inlet, revealing pathologic changes to the brachial plexus and other abnormalities. Biopsy has confirmed recurrence of the breast cancer. The diagnosis is lymphatic and hematogenous tumor spread. Ingenia 3.0T with dS HeadNeckSpine coil was used. Scan time 5:41 min. for T2-weighted, 6:23 min. for mDIXON TSE. Scans were optimized for high image quality rather than speed.

oncology patients and in brachial plexopathy patients. Soon I will use it for eye and orbit pathology and skull base lesions as well.”

#### mDIXON TSE addresses fat suppression, speed and image quality

“We often had to choose between scanning with or without fat suppression to keep the examination short. Sometimes it turned out we made the wrong choice because of imperfect fat suppression,” says Dr. Verbist. “The great thing about mDIXON TSE is that we don’t have to choose; we get both in one acquisition – and excellent image quality within an acceptable time. ExamCard times are reduced as fewer sequences need to be used.”

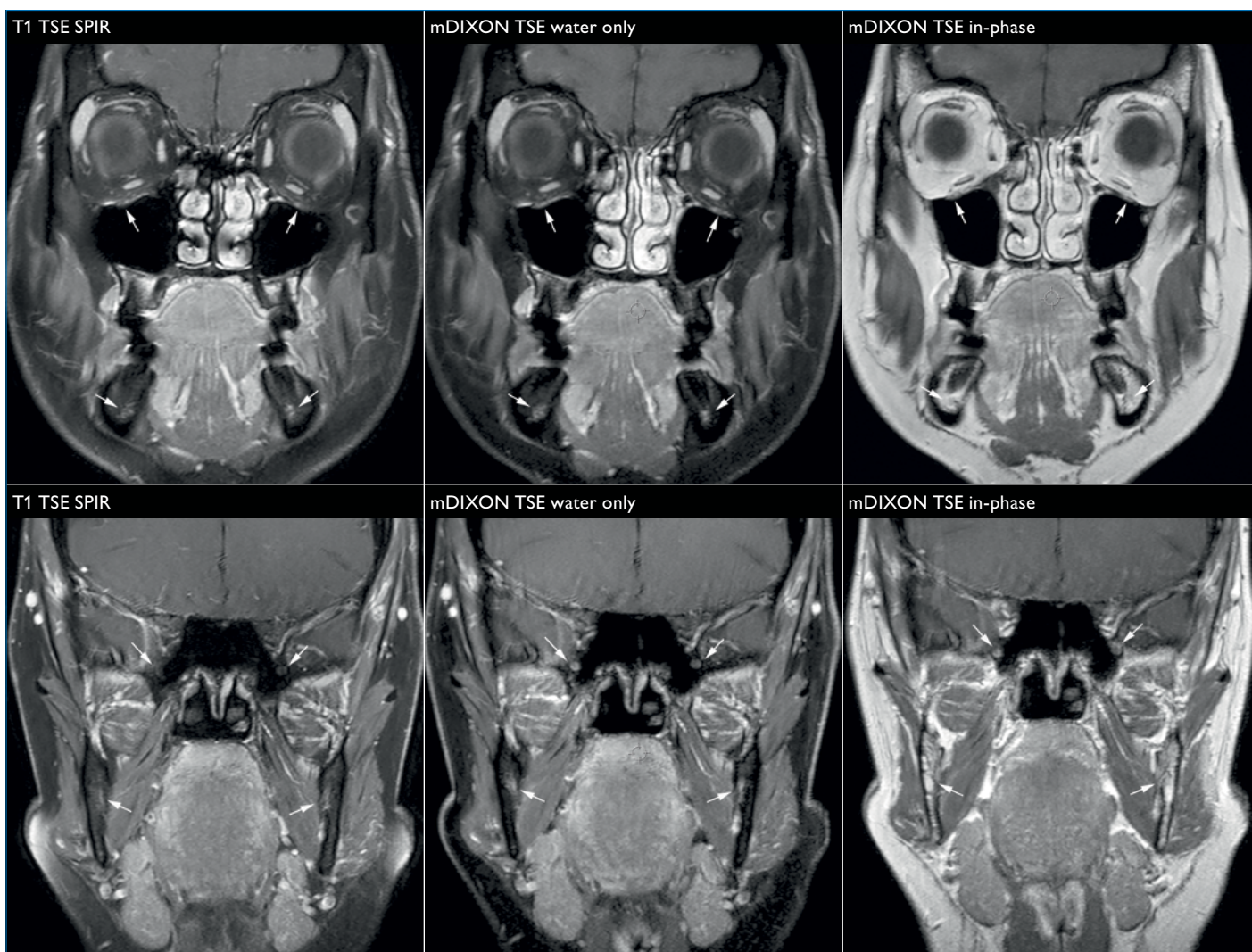
Philips’ patented mDIXON TSE uses 2-echo technology instead of the slower 3-echo method, and this enables fast scan time and high resolution simultaneously.

“With better image quality, we get better diagnostic accuracy,” Dr. Verbist explains. “mDIXON TSE can trigger a change in imaging strategies in head and neck imaging, as it provides excellent image quality

*“mDIXON TSE delivers homogeneous fat suppression, even when we use a large field of view.”*

and we need fewer scans in an exam, because we get the images with and without fat suppression in only one scan. We can also enlarge the field of view, so it will be easier to image the entire neck. And, reading these high quality images is faster; it’s just easier to look at them.”

“For fat suppressed spine imaging of post-operative patients, patients with suspicious lesions or spondylodiscitis, we currently use the STIR sequence, but that has an inherently lower SNR and T2 weighting isn’t very good with this technique. The homogeneous fat suppression of mDIXON TSE can also be an attractive alternative here. For MSK scanning, mDIXON TSE can allow us to enlarge the field of view and, for instance, easily scan both hips at the same time.”

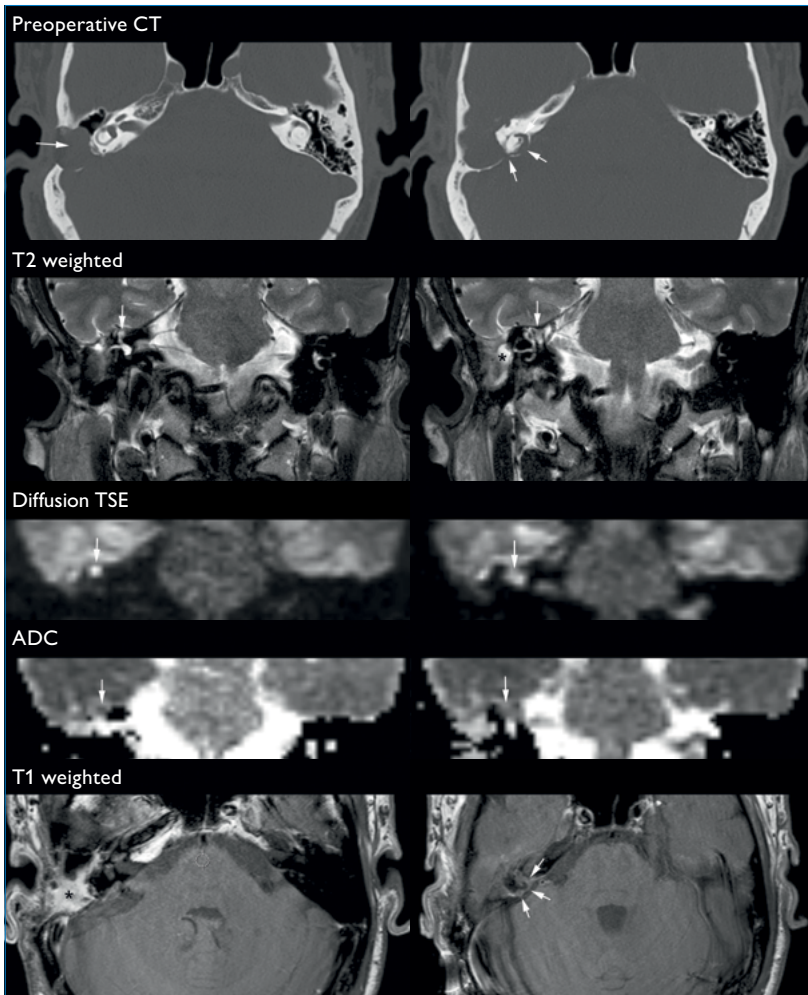


#### mDIXON TSE skull base imaging of trigeminal neuralgia (maxillary branch)

A 56-year-old female with severe pain along the cheekbone and upper jaw on the left and unremarkable clinical examination was referred for imaging of the trigeminal nerve (CN V). This requires highly focused imaging of the peripheral and central segments of the CN V. Fat suppression may be needed but has the risk of increased susceptibility artifacts along the skull base. With mDIXON, images with and without fat suppression can be obtained at the same time. Images are from the levels of the infraorbital nerve (top row) and the foramen rotundum (bottom row). Post-contrast T1 TSE SPIR images ( $0.47 \times 0.59$  mm pixels) show inhomogeneous fat suppression (for instance in the cheek) and susceptibility artifacts along the orbital floor and skull base, which obscure the regions of interest. Scanning an additional T1 TSE without fat suppression is required for better visualization of the infraorbital nerve (white arrows) and foramen rotundum (other color arrows). Instead, one mDIXON TSE scan

provides four image types including images with and without fat suppression (water only and in-phase, respectively) in one acquisition. Homogenous fat suppression and decreased susceptibility artifacts in the mDIXON images provide excellent delineation of all branches of the trigeminal nerve. Shown here are the infraorbital nerve (arrows top row), maxillary nerve in the foramen rotundum (arrow bottom row) and inferior alveolar nerve (branch of the mandibular nerve V3; arrowheads). This image quality is indispensable to help rule out underlying disease in neuralgia – as in our patient – or for evaluation of perineural area in oncologic patients. Ingenia 3.0T with dS Head coil was used. Scans were optimized for high image quality rather than speed. T1 TSE SPIR scan time 4:32 min. and 9:04 min for both with and without fat suppression; mDIXON TSE scan time 4:03 min.

*“The great thing about mDIXON TSE is that we don’t have to choose between scanning with or without fat suppression; we get both in one acquisition.”*



#### Postoperative Diffusion TSE of residual cholesteatoma

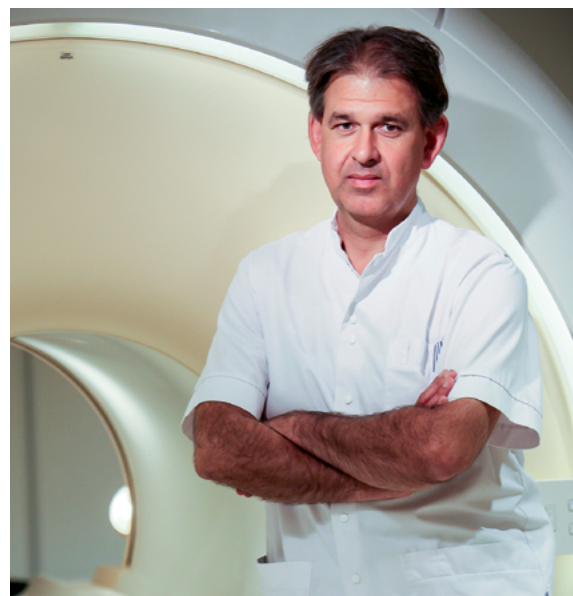
A 44-year-old male was operated on for recurrent cholesteatoma after previous ear surgeries. Due to the extent of the disease and the patient's wish to preserve hearing, the cholesteatoma could not be completely removed. Preoperative CT images show a large, expansive mass extending along the posterior border of the temporal bone towards the superior semicircular canal (SSCC) (arrows). Postoperative MRI was ordered to evaluate the residual disease. Coronal T2-weighted images show hyperintense signal medial to the SSCC (arrow) as well as lateral to the vestibular system (asterisk). On Diffusion TSE (non-EPI DWI, pixels  $1.79 \times 2.32$  mm, scan time 4:20 min.) hyperintense signal is present medial to the SSCC, with low signal intensity on the corresponding ADC mapping. This restricted diffusion is compatible with residual cholesteatoma. T1-weighted images (pixels  $0.47 \times 0.59$  mm, 3:47 min.) confirm the presence of cholesteatoma (arrows) medial to the SCC, whereas the mastoid cavity is filled with granulation tissue (asterisk). Diffusion TSE (non-EPI DWI) is quick and easy to obtain and has been shown to have a high sensitivity and specificity for detection of cholesteatoma. Achieva 3.0T, 32-channel SENSE Head coil.

#### Diffusion TSE helps reduce susceptibility distortion

Dr. Verbist has also begun to use Diffusion TSE in head/neck imaging. "Again, the motion and the susceptibility in this area can distort standard EPI diffusion images enormously. In the brain we can use EPI diffusion, but in head and neck we need a method that is less prone to susceptibility artifacts. In addition, we need very thin slices, and yet it shouldn't take too long. Diffusion TSE solves this by providing high quality images in a short acquisition time."

"There are several indications for Diffusion TSE in head and neck, such as otology and oncology. It's a very interesting and growing field at the moment. I've been using it a lot to help in assessment for cholesteatoma, which can result after chronic infection in the middle ear. Usually when patients have surgery for this condition, they will have another surgery about a year later to look for residual disease, but when we are able to visualize recurrent or residual disease with Diffusion TSE, we can make a better selection of the patients who will undergo a second operation. It's also becoming more common to use Diffusion TSE for imaging primary cholesteatoma, in patients who have not yet had surgery. Those patients are first scanned with CT, but often CT shows total obscuration of the middle ear making it difficult to determine whether it's inflammatory changes or cholesteatoma. Diffusion TSE helps to differentiate that."

As Dr. Verbist brings mDIXON TSE and Diffusion TSE into routine practice, she is pleased with the process. "It's an easy transition, because these are time-efficient techniques; they simply provide better images with fewer artifacts." ■



Senior technologist  
**Guido van Haren** at LUMC.