Experience of Using a New Autopilot Assistance System for Easy Scanning in Brain and Knee MRI Examinations

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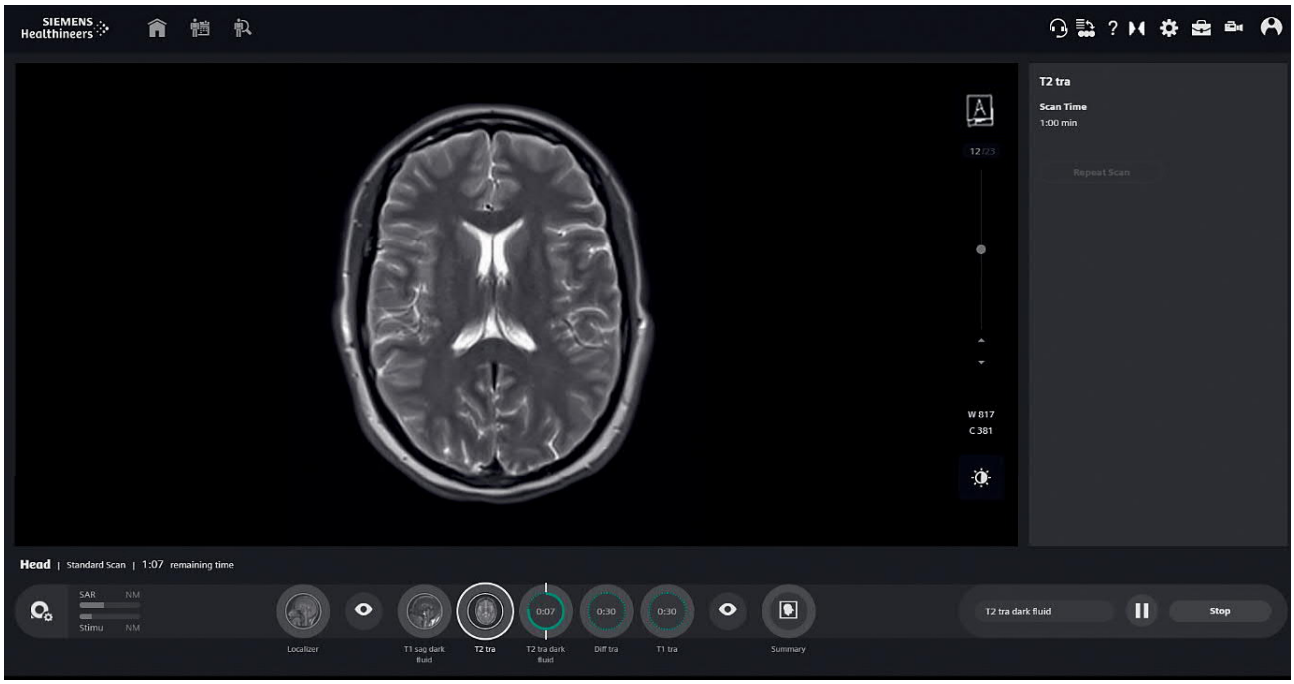
Context

The number of diagnostic MRI examinations is rising at a time when cost pressure is high in radiology. As a result, workloads are increasing. Imaging providers are therefore looking for new solutions that will deliver high quality care at optimized, low costs (= productivity) and enable more employees to carry out the examinations. Since qualified staff is expensive and, in some places, hard to find, technological advancements could become the key to success for reproducible magnetic resonance imaging.

New scanning assistance systems are needed if radiologists and imaging providers are to cope with the increasing demand and the high expectations of quality while only having a limited workforce.

We report on our initial experiences with a new technology, myExam Autopilot, to describe the possibilities offered by the novel solution. The focus was on standard brain and knee MRI examinations, which account for a large share of routine examinations.



1 Screenshot of the myExam Autopilot prototype showing the simplified and more intuitive user interface for a brain scan.

Aims

- To evaluate the scope for enabling low-skilled and inexperienced radiology technologists to perform reproducible, standardized MRI examinations of the brain and knee with no specific training and no individual support
- To evaluate whether the automation gives experienced users more time for other tasks

myExam Autopilot: Background

New automated scanner software has recently been developed and will be tested for brain and knee MRI examinations: myExam Autopilot for the brain and knee offers fast, reproducible, and standardized MRI examinations. It supports multiple exam strategies (e.g., standard, fast, standard with contrast agent) so that the strategy can be adapted to the local situation. The aim is to use the advanced workflow automation for standardized scan volume positioning, tilting, and coverage in order to achieve a high degree of consistency between examinations and to provide better support for inexperienced users.

Consequently, myExam Autopilot completely removes the need for individual users to manually adjust the protocols. It also features a greatly simplified and therefore more intuitive user interface. The system guides users through an automated workflow that allows them to scan intuitively, while artificial intelligence helps set the slice position, tilt, number of slices, and the individual examination steps: After entering the patient data, the preselected exam card opens automatically. The AutoAlign Localizer starts at the touch of a button. It provides landmarks and orientation for automatic positioning of the slices in a standardized way independent of the operator. AutoCoverage ensures the anatomy under examination is covered consistently throughout the entire examination. The myExam Autopilot program uses this information to automatically plan the preprogrammed sequences and then allows them to run. Overall, the user has to do very little.

Method

We evaluated myExam Autopilot in a test phase from June to August 2020. We investigated 24 routine examinations of the brain and eight examinations of the knee joint using standard MRI that was pre-configured with fixed sequences. The examinations were performed by six different users, three of whom were inexperienced.

Dot Engine vs. myExam Autopilot

myExam Autopilot provides user assistance and automation beyond the current Dot technology.

Dot Engine:

- Automatic planning powered by AI
- Standardized examination protocols, adaptable to institutional needs
- Possibility to set-up scan strategies and decisions

myExam Autopilot adds further functionalities:

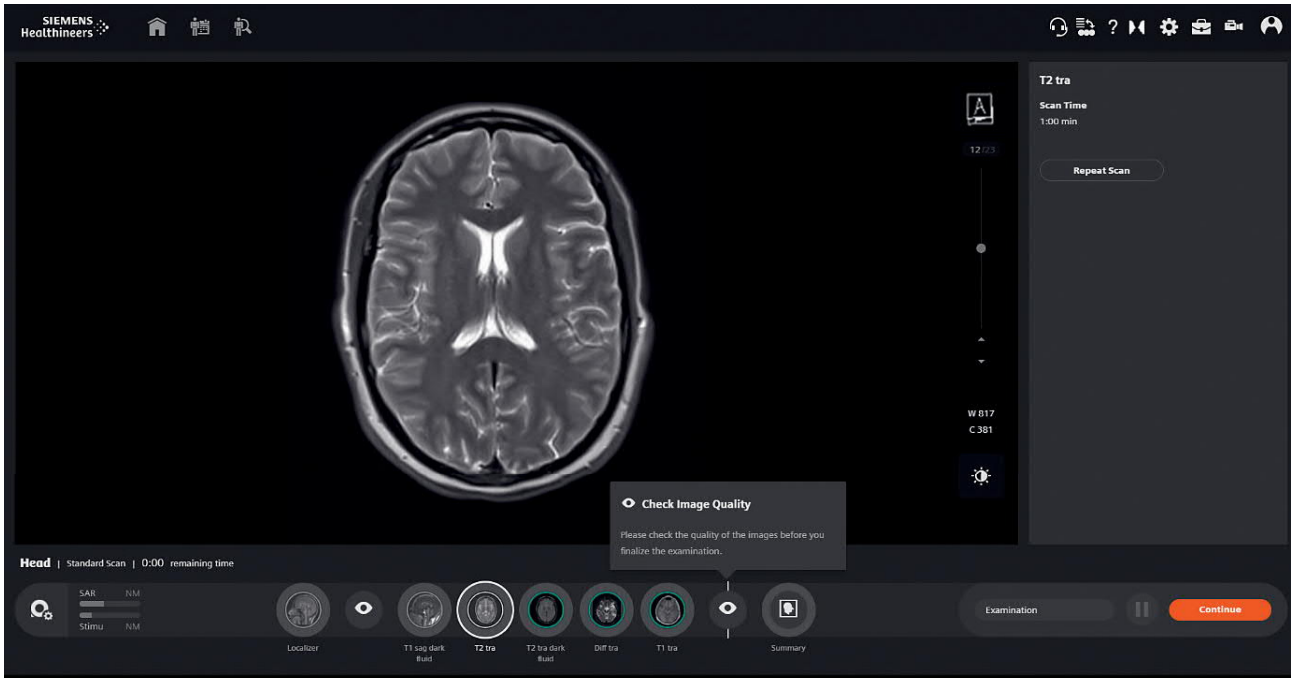
- MRI at the click of a button
- Automated protocol without the need for manual adjustment
- Drastically simplified user interface (touch screen supported)
- Visual user guidance text, e.g., for image QA

The inexperienced group included users of different modalities, e.g., CT, who are rarely involved in performing MRI examinations.
The standard sequences were as follows:

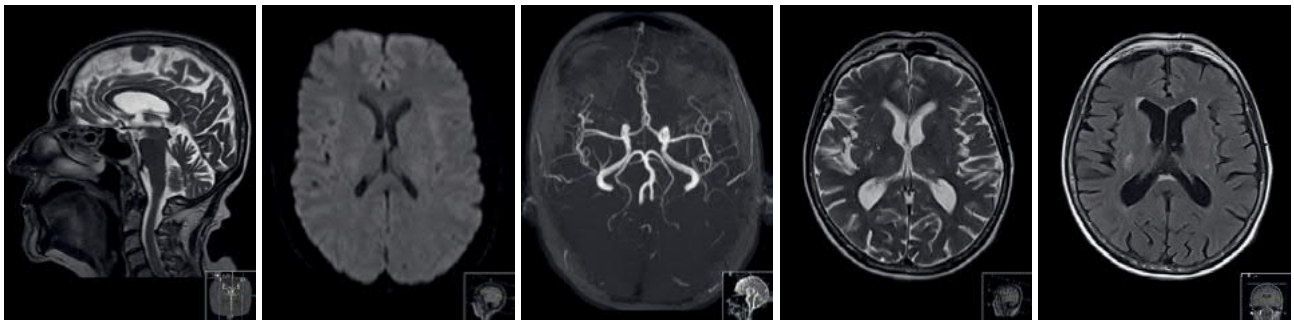
- Brain: transverse Dark-fluid, transverse T2-TSE, transverse DWI, transverse T1-SE, transverse T2-GRE, sagittal T2-TSE, sagittal DWI, TOF angiography of the circle of Willis.
- Knee: sagittal PD FS-TSE, sagittal PD-TSE, coronal and transverse PD FS-TSE, coronal T1-TSE.

Results

All users had a positive initial impression of myExam Autopilot and were confident using it. They needed just a brief introduction to be able to use the software, and were familiar with its operation after using it just once or twice. The three inexperienced users liked the user-friendliness and felt that the workflow was easier and required less effort. They were able to use the program after a brief introduction and no extra training. As their uncertainty regarding the complexity of conventional scan protocols was no longer an issue, they also saved time during the examination.



2 Screenshot of the prototype showing integrated guidance text in the workflow. Further support is provided by automatic planning from AutoAlign and AutoCoverage for consistent slice or volume coverage and orientation.



3 A brain MRI examination with myExam Autopilot performed by an inexperienced user.

For the three experienced users, the new workflow was unfamiliar and offered less scope for making manual adjustments. For them, it was helpful and important to be able to switch to the conventional user interface (myExam Assist) so that they could change or supplement sequences, if required for the individual case. As a result, the experienced users spent similar time on scanning and system operations as the unexperienced group. Additional myExam Autopilot exam strategies could reduce individual adjustments so that experienced users could also benefit from time savings. This remains to be evaluated further.

Both user groups were able to achieve high quality diagnostic results which were evaluated by the radiologists involved in this study. The diagnostic results of the new program provided the same quality as the original Dot Engine software.

The automation of the myExam Autopilot software worked reliably and delivered consistent results in both groups. The slice groups were correctly positioned in all examinations. The sequences ran without error and image reconstruction occurred promptly.

One issue that the experienced users felt should be addressed was that inexperienced users were less critical of the automated exam and accepted it without checking it or, if necessary, supplementing it or repeating blurred sequences. This issue could be resolved by raising awareness through training.

Discussion

Given the aims of the evaluation, the following conclusions can be drawn:

- myExam Autopilot helps less experienced users to carry out MRI scans with consistently high image quality.
- myExam Autopilot is an intelligent solution that addresses the increasing global demand for MRI examinations.

It is a very stable, reliable method for performing routine exams of the brain or the knee. The automatic positioning is very robust and almost entirely unsusceptible to errors. Performing a standard exam is easy to learn and requires just a few steps and minimal interaction. myExam Autopilot makes particular sense in scenarios such as occupational medical examinations performed by technologists who do not normally use MRI workstations, and standard MRI examinations that are carried out in regions with limited access to MRI and no access to staff with specific MRI training. myExam Autopilot is currently being expanded to include spine MRI exams, which are also increasingly in demand. This will be a welcome addition to the technology.

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