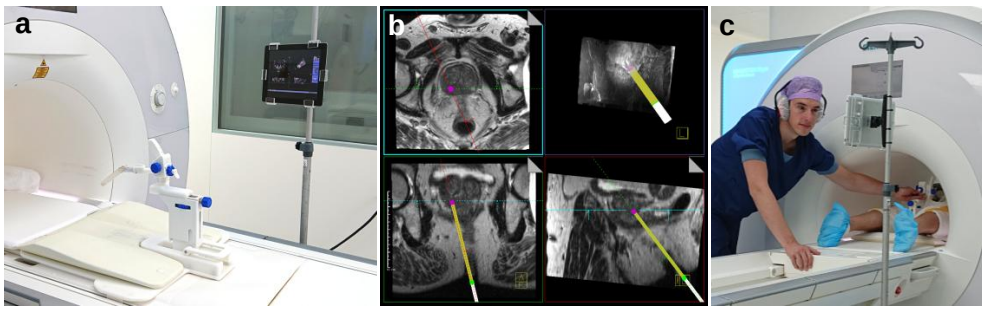
Real-time Needle-guide Alignment during 3-T in-bore MR-guided Prostate Biopsy using an In-room Tablet Device: Initial clinical experience

C.G. Overduin[1], J. Heidkamp[1], E. Rothgang[2,3], J.O. Barentsz[1], F. de Lange[1], J.J. Fütterer[1,4]

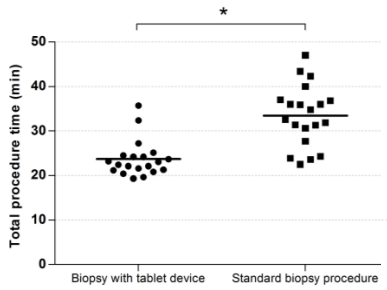
[1]*Department of Radiology and Nuclear Medicine, Radboud University Medical Center, Nijmegen, the Netherlands*
[2]*Siemens Corporate Research, Erlangen, Germany*
[3]*Ostbayerische Technische Hochschule, Amberg-Weiden, Germany*
[4]*MIRA Institute for Biomedical Engineering and Technical Medicine, University of Twente, Enschede, the Netherlands*

Purpose To assess the feasibility of real-time needle-guide alignment on an in-room tablet device during transrectal 3-T in-bore magnetic resonance (MR)-guided prostate biopsy.
Methods Twenty patients with one cancer suspicious region (CSR) with PI-RADS v2 score ≥4 on diagnostic multi-parametric MRI were prospectively enrolled in this IRB-approved study. An MRI safety assessment[1] was performed to establish the safe operating conditions of the tablet device (iPad 2, Apple, California, USA) in the MR-suite. Hereafter, the tablet device was installed in the MR-suite and connected to a stand-alone computer outside the scanner room via a remote desktop application (VNC Viewer, RealVNC, Cambridge, UK) (Fig.1a). Biopsy procedures were performed on a 3-T clinical MR system (Magnetom Skyra, Siemens, Erlangen, Germany) by one prostate interventionalist. After CSR-reidentification, two orthogonal scan planes of an MR-fluoroscopy sequence (~3 imgs/s) were aligned to intersect both the biopsy target point and the pivoting point of the transrectal needle-guide (Invivo, Schwerin, Germany) using planning software (Interactive Frond End, Siemens, Erlangen, Germany) (Fig.1b). Targeting of the CSR was then performed by manipulating the needle-guide into both scan planes under MR-fluoroscopy feedback visualized on the tablet device in the scanner room (Fig.1c). Technical feasibility and single-step targeting success were assessed. Complications and biopsy procedure times were also recorded. A reference cohort (n=20) that underwent standard in-bore MR-guided biopsy for same indications was retrieved from our institutional database as initial reference. Statistical analysis was performed to evaluate biopsy times between groups.
Results Needle-guide alignment on the in-room tablet device was technically successful in all patients and allowed sampling of each CSR (median size 14 mm, range: 4-45) after a single alignment step in all but one patient (19/20 lesions; 95%). Biopsy cores contained cancer in 18/20 patients. There were no per-procedural or post-biopsy complications. Using the tablet device, mean time to first biopsy was 50% (5.8±1.0 min. vs. 11.6±5.0 min; P<.001) and mean total procedure time 29% (23.7±4.1 min. vs. 33.4±6.9 min; P<.001) (Fig.2) reduced compared to the reference cohort.
Conclusions Real-time needle-guide alignment with use of an in-room tablet device was feasible and safe during transrectal 3-T in-bore MR-guided prostate biopsy. Our initial clinical experience indicates potential for procedure time reduction compared to the standard biopsy procedure.

References 1. ASTM F2052-15, www.astm.org, 2015. DOI: 10.1520/F2052-15



▲ **Fig.1** – a) Setup of the tablet device in the MR-room. b) IFE planning module where the biopsy target (pink) and needle guide pivoting point (green) were set. The software then calculates the planned trajectory through these points (yellow path), representing the desired needle guide trajectory to target the cancer suspicious region. c) Real-time alignment of the needle-guide is performed under MR-fluoroscopy feedback displayed on the tablet device.



◄ **Fig.2 –** Total procedure times for biopsy with use of the in-room tablet device and the routine biopsy procedure, with means indicated. * = P<.001.