

The effect of rectal retractor on intrafraction motion of the prostate

A. Vanhanen^{*,1,2}, M. Kapanen^{1,2}

¹ Department of Oncology, Unit of Radiotherapy, Tampere University Hospital, POB-2000, 33521 Tampere, Finland

² Department of Medical Physics, Medical Imaging Center, Tampere University Hospital, POB-2000, 33521 Tampere, Finland

*antti.vanhanen@pshp.fi

OBJECTIVES

Rectal retractors (RR) are used in prostate radiotherapy to retract part of the rectal wall further from the prostate in order to lower the rectal dose and toxicity. The aim of this study was to investigate the effect of RR on intrafraction motion of the prostate by using electromagnetic real-time tracking system.

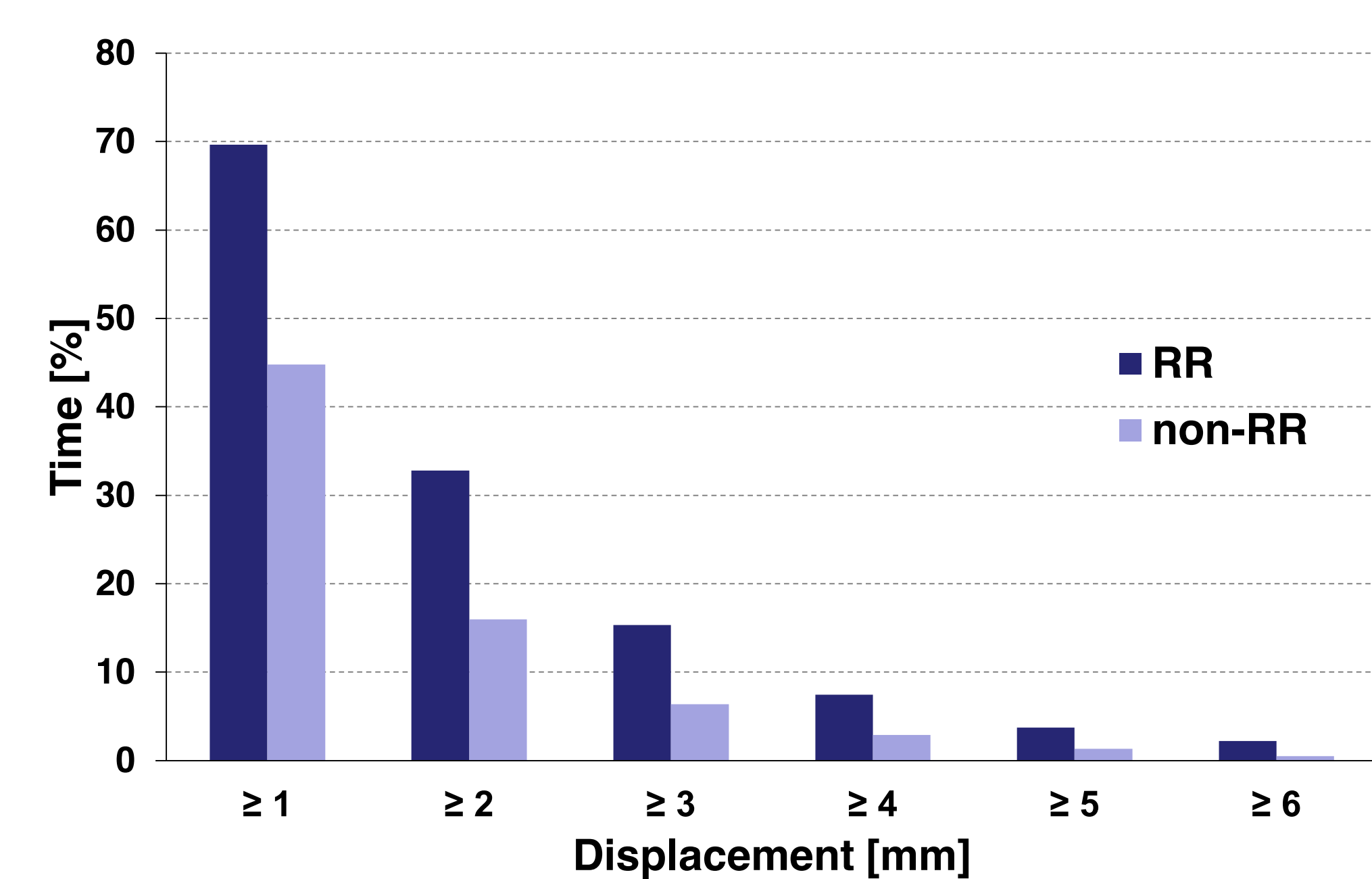


Figure 2. Average percentage time of prostate 3D displacements within 10 min of tracking time. Difference between RR and non-RR fractions was statistically significant ($p < 0.03$).

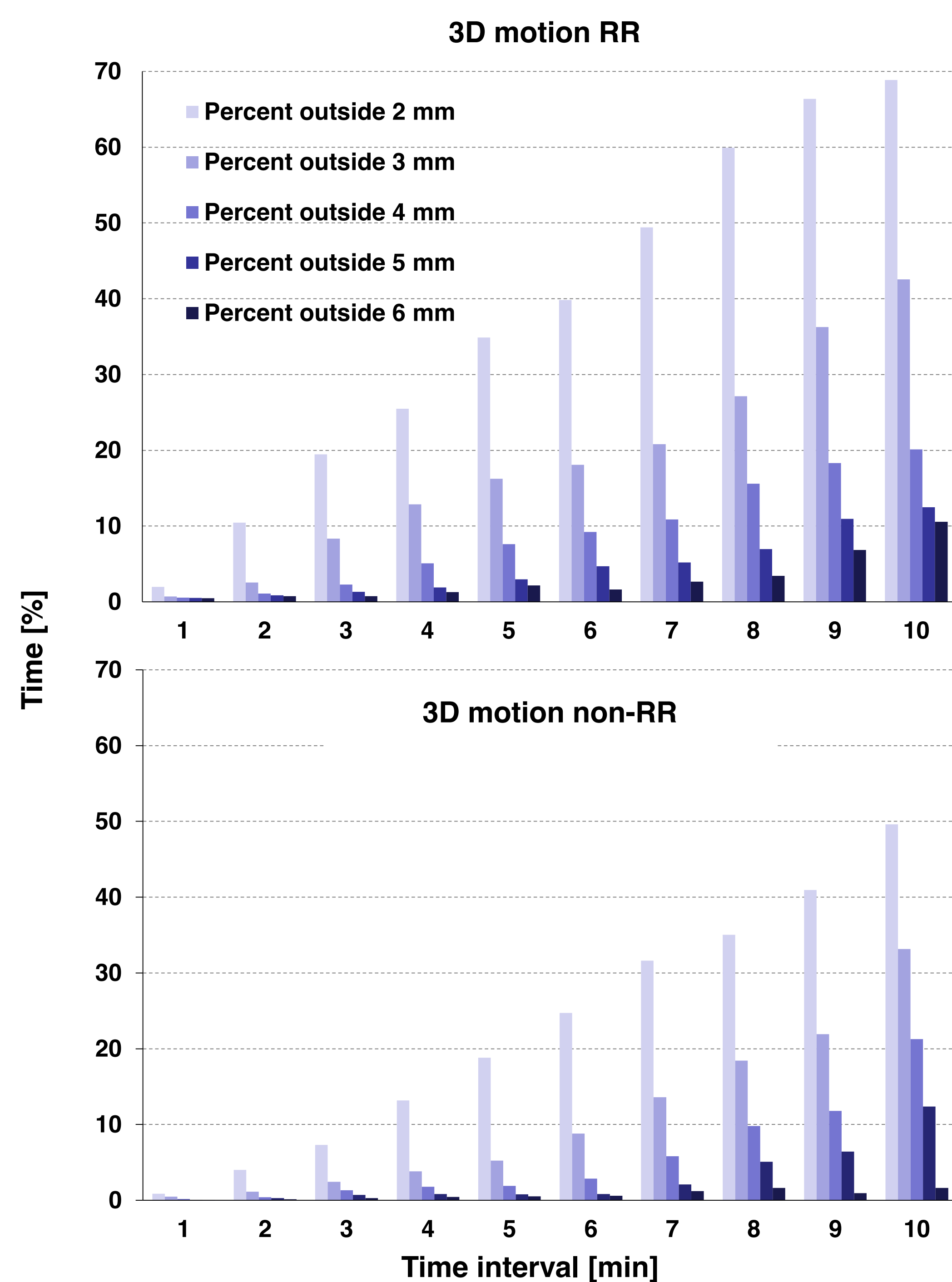


Figure 5. Observed temporal patterns of prostate 3D displacements in RR and non-RR fractions.

METHODS

RR (Rectafix, Scanflex Medical) (**fig. 1**) was used in 10/20 and 15/39 fractions depending on the fractionation scheme of 28 prostate cancer patients recruited in the study. Intrafraction motion of the prostate was recorded with electromagnetic real-time tracking system (RayPilot, Micropos Medical). Motion data of 260 RR fractions and 351 non-RR fractions from 22 patients could be analyzed. 3D and unidirectional motion patterns between RR and non-RR fraction datasets were compared in terms of average percentage time at displacement ≥ 1 -6 mm over ten minutes of tracking time. Temporal patterns of the prostate motion were evaluated by re-binning the motion data in 1-minute time intervals.

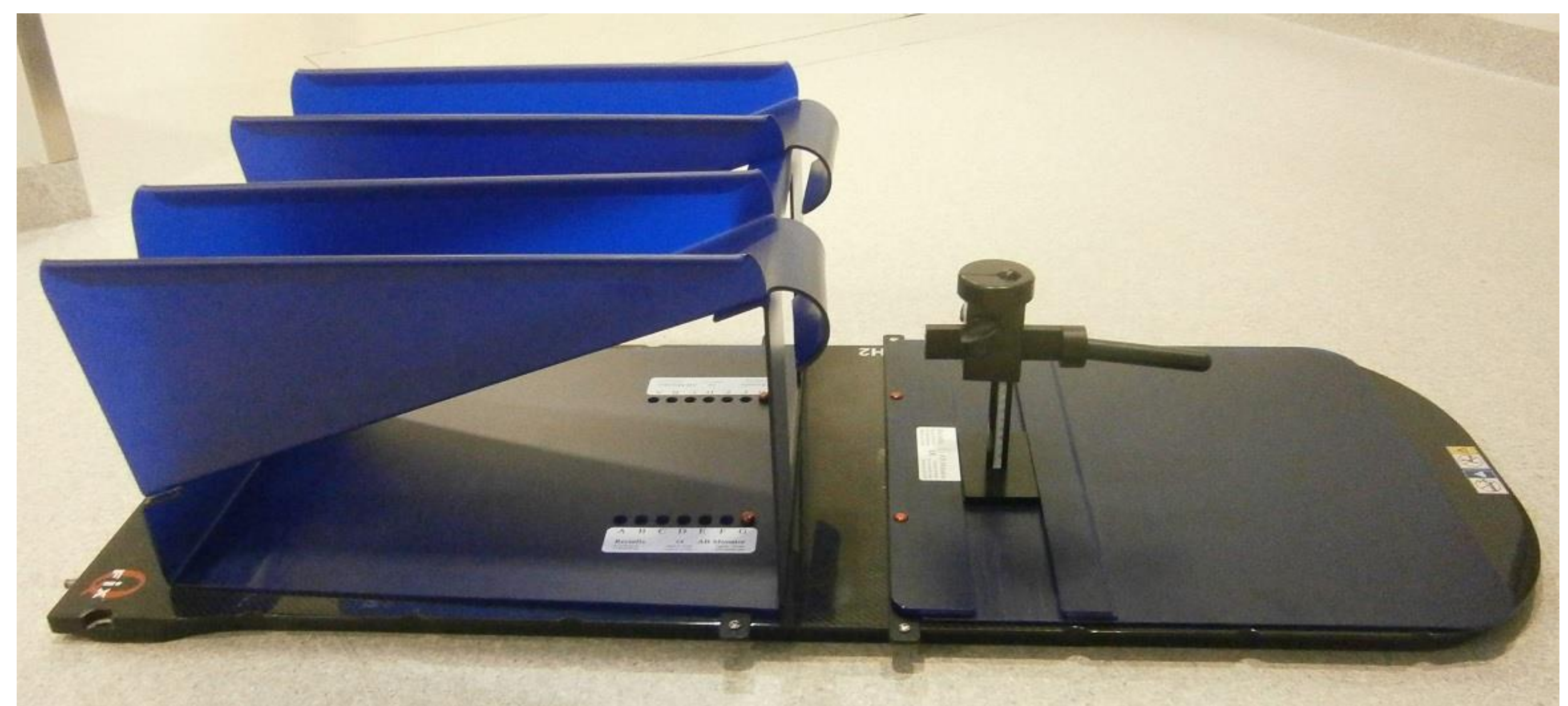


Figure 1. Rectafix consists of a rectal rod, an adjustable vertical column and a leg support.

RESULTS

The average percentage time at displacement was larger in RR data compared to non-RR data in every direction (except anterior) and motion magnitude considered (**fig. 2**). Largest increase in the motion was seen in inferior and posterior directions (**fig. 3 and 4**) when the RR was used. The probability of larger displacement increased as a function of elapsed tracking time in both RR and non-RR datasets but the increase was more rapid with RR (**fig. 5**).

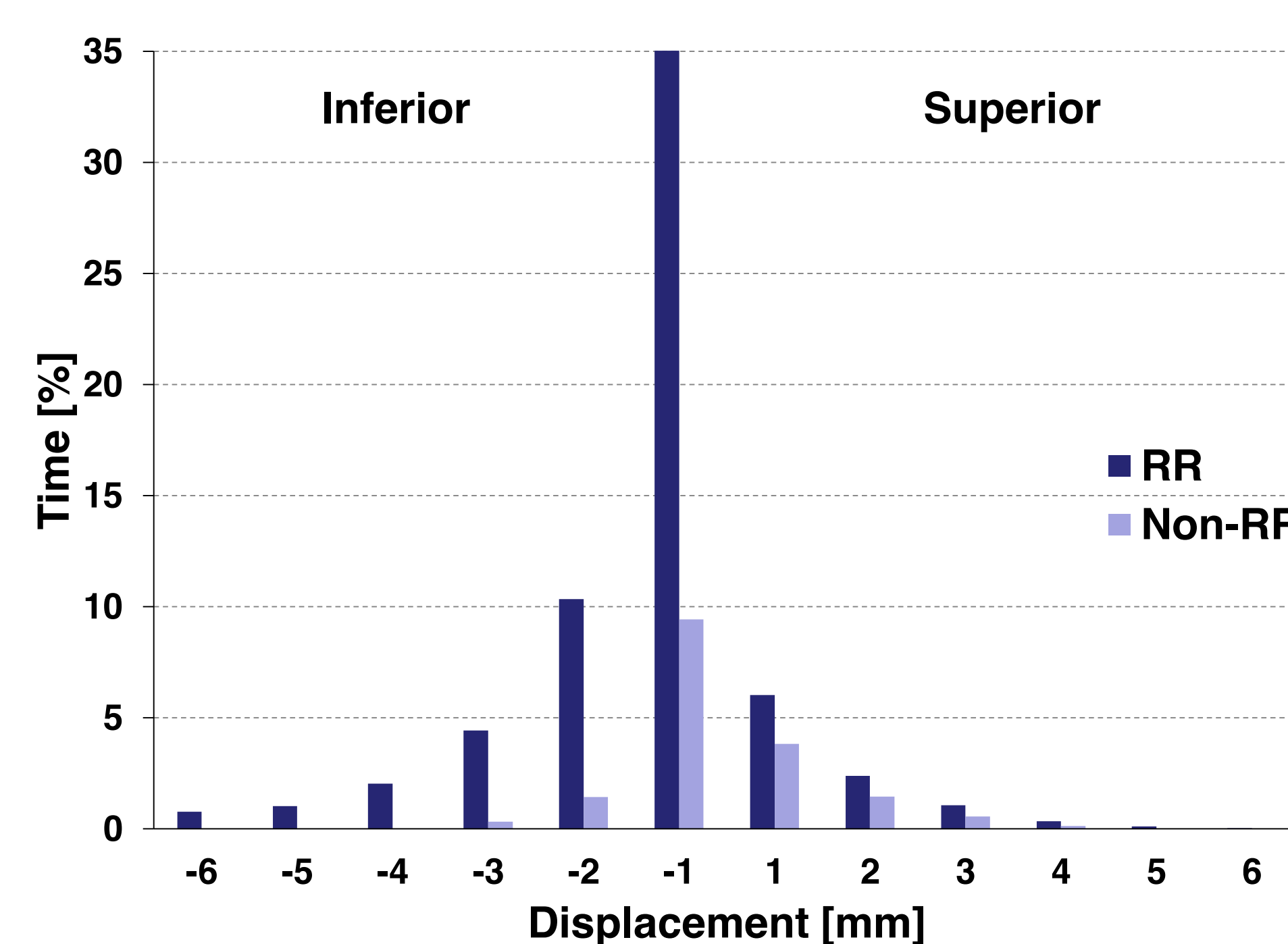


Figure 3. Superior-inferior motion distribution.

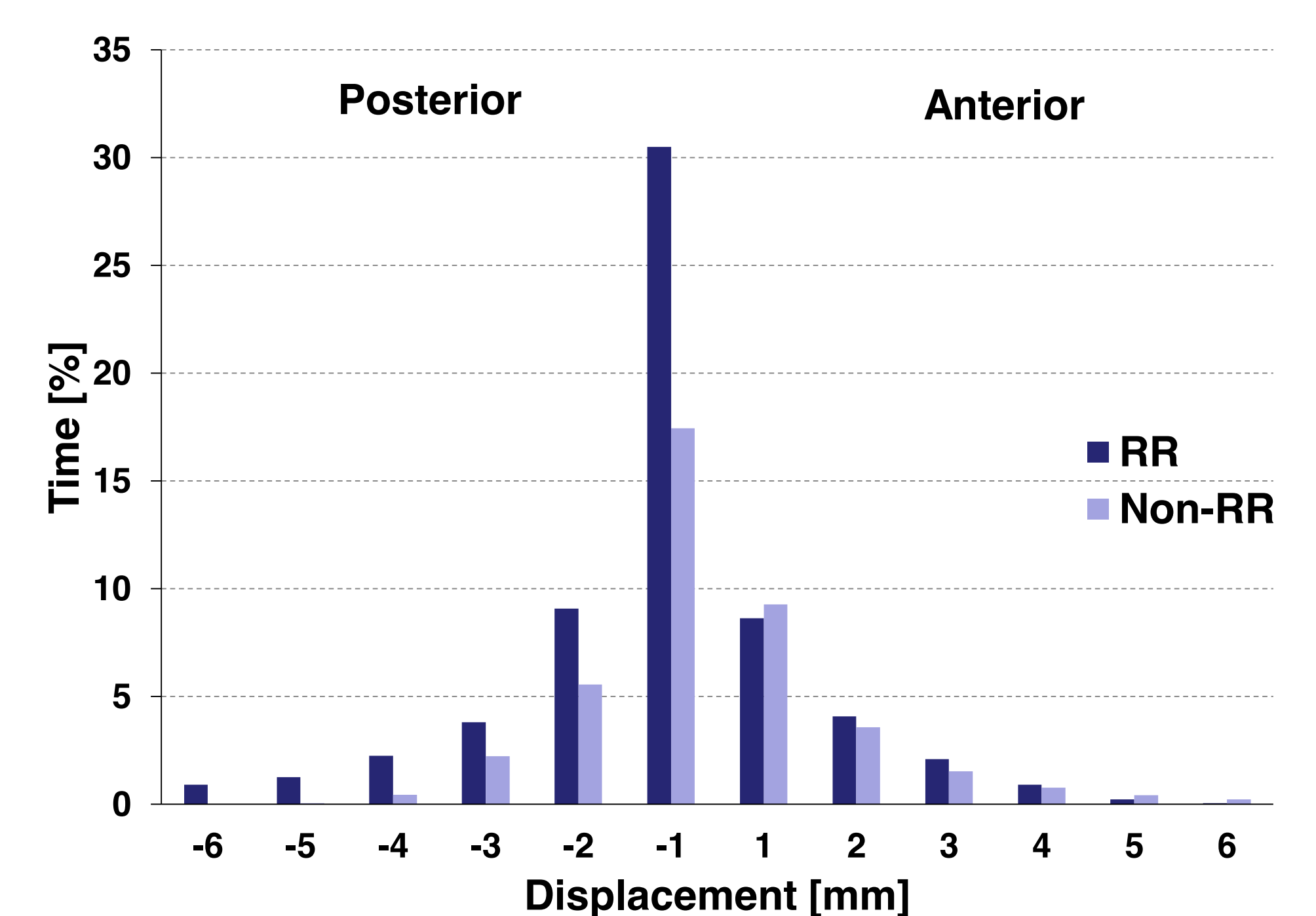


Figure 4. Anterior-posterior motion distribution.

CONCLUSIONS

In the present study the effect of the RR on intrafraction motion of the prostate was assessed for the first time using real-time motion tracking. The results imply that the use of the RR increases the intrafraction motion when compared to motion data recorded in normal patient setup without the RR. Increased motion can lead to inaccurate treatment localization and delivery and may compromise the dose sparing effect of the RR.