**Purpose:** To demonstrate automatic patient head motion management with non-magnetic and non-radiation attenuating robots. Contrary to current methods, this would (i) negate the deleterious effects of interfractional setup variation; (ii) correct the complex intrafractional geometric uncertainties; (iii) eliminate radiation attenuation associated with currently used metallic frames; and (iv) correct drifting errors associated with thermoplastic face masks for patients.

**Methods:** A soft robot mechanism is designed to move the patient’s head into desired trajectory regimes. The soft robot consists of non-attenuating and non-magnetic soft actuators, whose deformations are governed by pressurized air. The mechanism’s actuators control independent freedoms as shown in Table I. Inspired from the behavior of the papillae of cephalopods, the dome-like soft actuators (Table Ie) are planar in their reference configuration, and they transform into full 3D structures after actuation. This deformation property allows them to execute prehensile manipulation of the head (see Table II: (a)-(d)) that is fast and precise.

**Results:** Charts (e) and (f) of Table II shows the displacement of the head from a rest position (0mm) to a target position (10mm) above the table based on a CCOARSE deformation of the base actuators. The head reaches the desired target in world coordinates within a rise time of <20%.

**Conclusions:** This work shows the potential ofreal-time head motion correction with non-magnetic and a radiation-transparent soft robots adaptable for standalone MRIs using. The proposed technology can be used in emerging hybrid MRI-linear accelerators; and can spur the emergence of a better brain and head and neck (H&N) cancer management technology that can be adapted to confined spaces under MRI coils. Their continuum nature assures minimal invasiveness and patient comfort. Their actuation medium (air) eliminates the risk of electronic/metallic parts that are unsuitable for the MRI’s magnetic fields and makes it safe for human-robot interaction.