

3 - 41 Bio-audiovisual Feedback Breathing Guidance Technique for Synchrotron-based Ion Beam Delivery

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Based on the periodic synchrotron-based beam delivery, a bio-audiovisual feedback breathing guidance technique has been developed to mitigate the interplay between target motion and dynamic beam delivery for ion beam therapy, in which variable beam extraction and generation of individualized breathing guidance curve are two key factors. Shown in Fig.1 is the schematic diagram of the breathing guidance technique. Through the simulations with 15 healthy volunteers for the breathing guidance technique, we found not only the treatment efficiency of synchrotron-based pulsed ion beam could be increased effectively, but also the residual movement of respiration during gating window could be reduced. In the test with 7 lung cancer patients, the synchronization between the respiration motion characterized by the ups and downs of abdominal wall and the movement of patient diaphragm was observed using X-ray fluoroscopy, indicating breathing guidance by means of external surrogate reflects the regularity of internal target motion. Dose calculations showed that the breathing guidance technique restored the expected distributions for both passive and active scanning beam deliveries. Collectively, the bio-audiovisual feedback breathing guidance technique was demonstrated to be considerably useful for synchrotron-based ion beam therapy in terms of increasing treatment efficiency and reducing residual target motion. We believe this technique provides a substantial support for respiration gating method used in ion beam therapy.

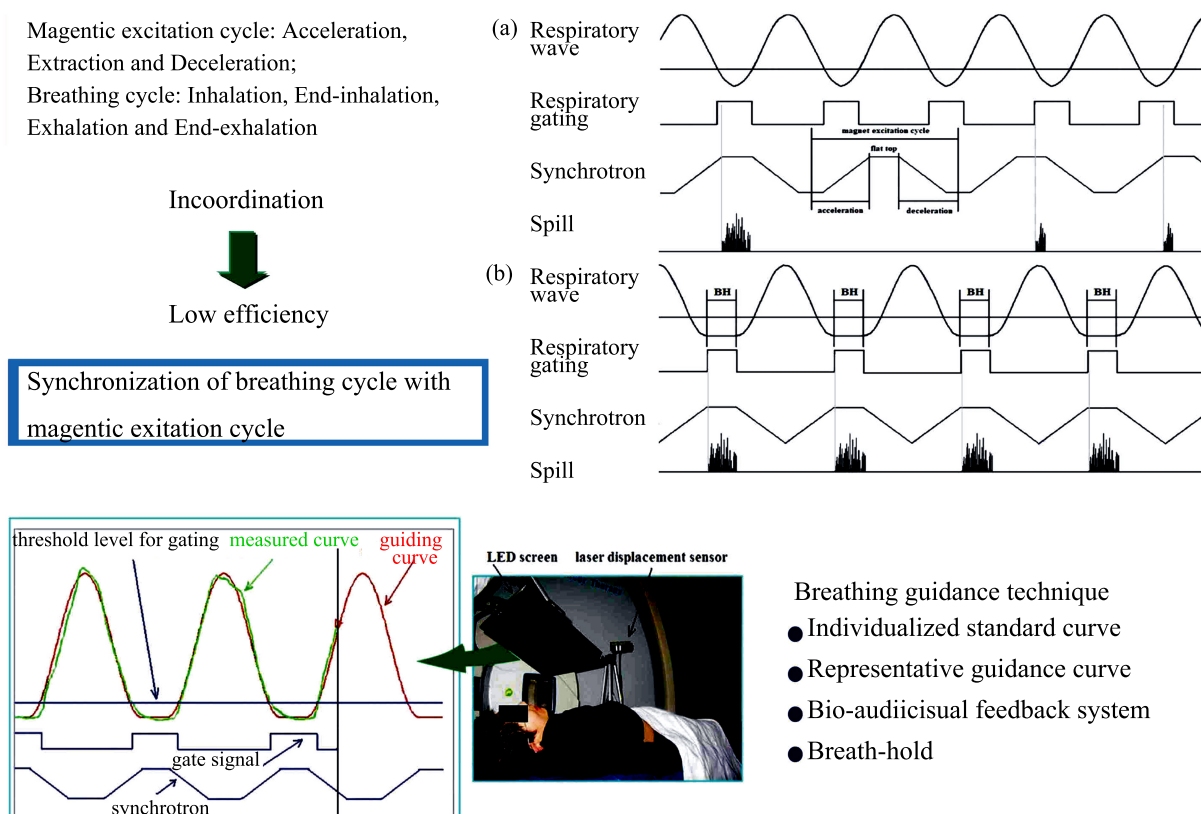


Fig. 1 (color online) The shcematic diagram of the breathing guidance technique developed for synchrotron-based ion beam delivery.