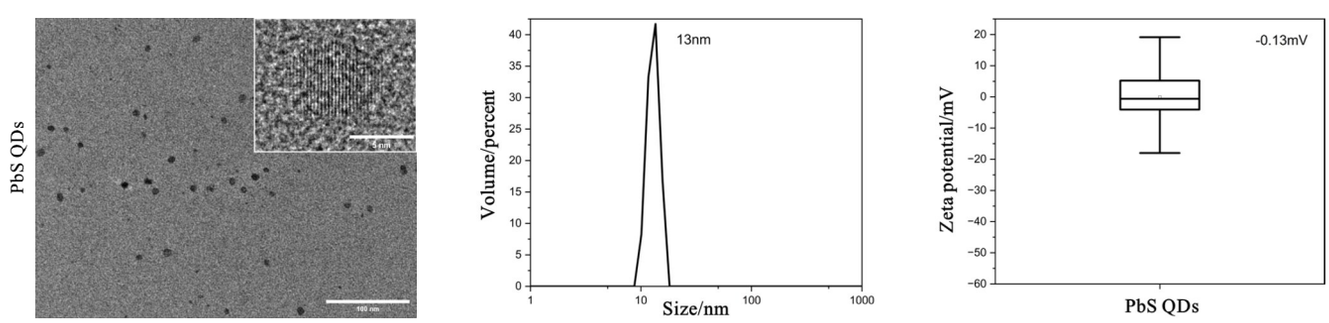
NIR-II imaging quantum dots exosomes peripheral nerve injury vascular injury



a b c

Fig. 1 Characterization of PbS QDs: (a) the TEM image(scale bar = 100 nm; inset scale bar = 5 nm); (b) particle size and distribution; (c) average zeta potential of PbS QDs

1 PbS QDs a =100nm =5nm b c Zeta

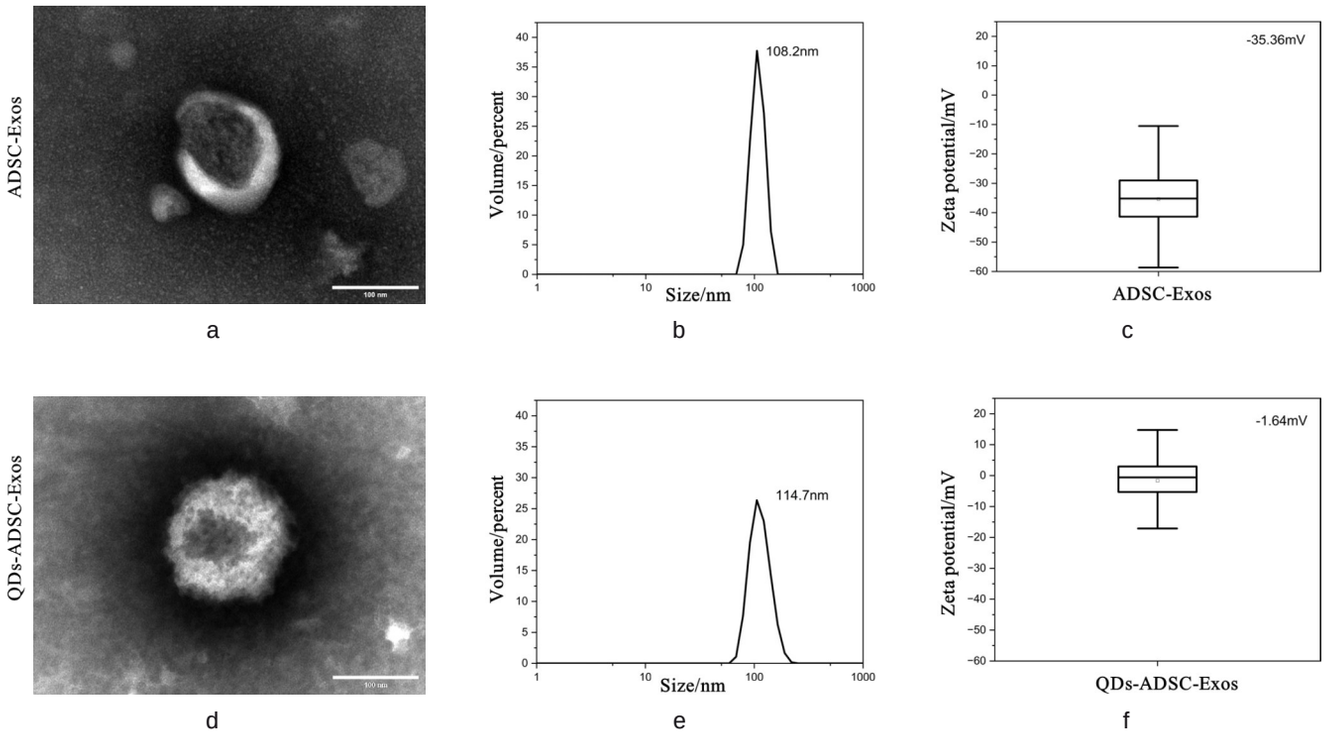


Fig. 2 Characterization of ADSC-Exos and QDs-ADSC-Exos: (a) the TEM image(scale bar = 100 nm); (b) particle size and distribution; (c) average zeta potential of ADSC-Exos; (d) the TEM image(scale bar = 100 nm); (e) particle size and distribution; (f) average zeta potential of QDs-ADSC-Exos

2 ADSC-Exos QDs-ADSC-Exos ADSC-Exos a =100nm b c Zeta QDs-ADSC-Exos d =100nm e f Zeta

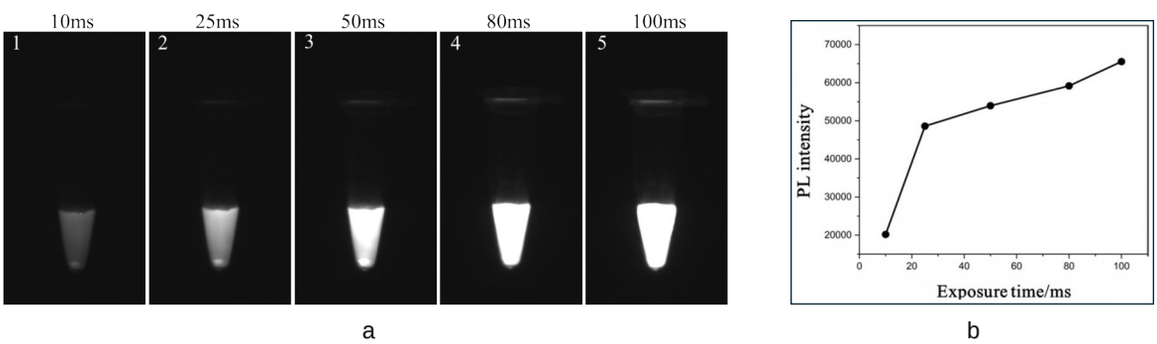


Fig. 3 Optical property of the QDs-ADSC-Exos: (a) QDs-ADSC-Exos with NIR-II fluorescence imaging at different exposure times (10 ms, 25 ms, 50 ms, 80 ms, 100 ms, λex: 808 nm); (b) PL intensity in NIR-II imaging across different exposure times

3 QDs-ADSC-Exos QDs-ADSC-Exos a 10 ms 25 ms 50 ms 80 ms 100 ms NIR-II λex: 808 nm b NIR-II PL

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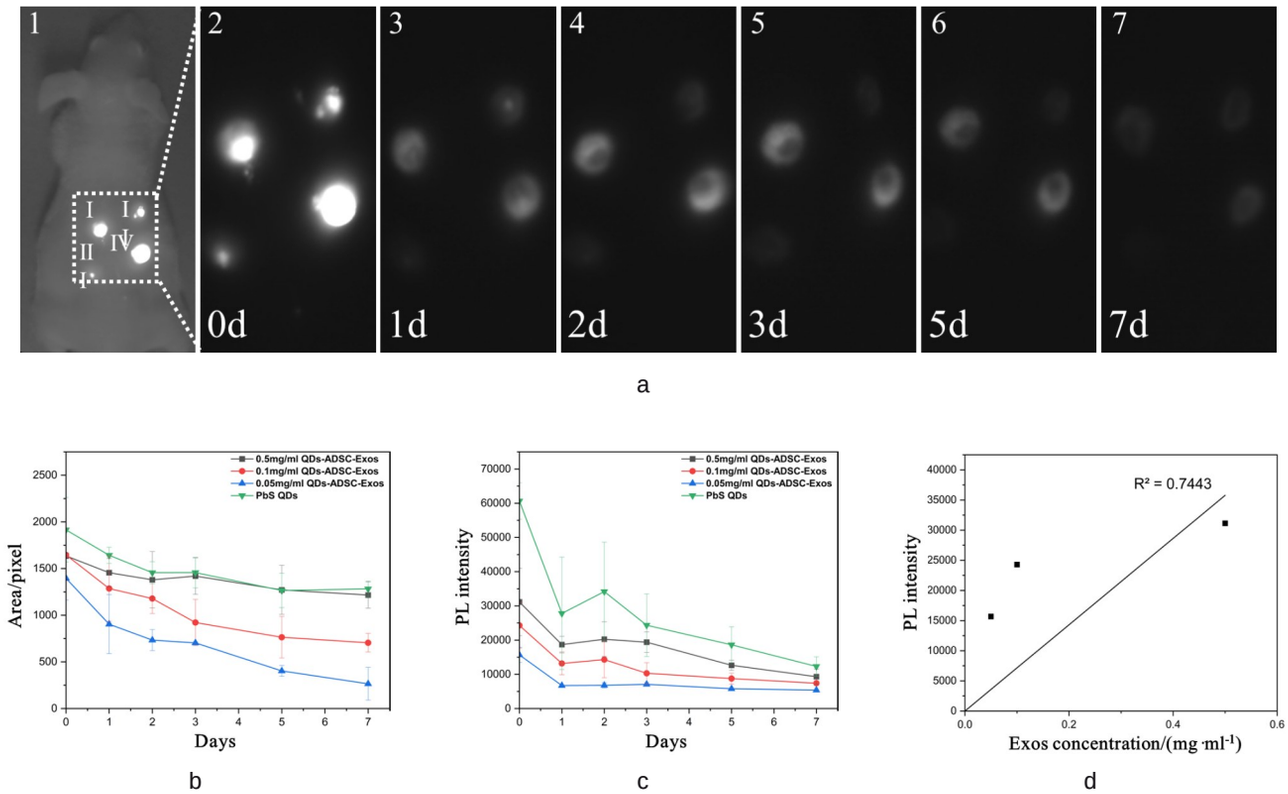

Fig. 4 Validation of the sensitivity and stability of QDs-ADSC-Exos in vivo: (a1-a7) NIR-II fluorescence imaging of QDs-ADSC-Exos and PbS QDs injected subcutaneously into the dorsal region of nude mice at 0, 1, 2, 3, 5, and 7 days post-injection. Regions I, II, III, and IV correspond to injection sites of 0.5 mg/ml, 0.1 mg/ml, 0.05 mg/ml exosomes, and PbS QDs, respectively (λex: 808 nm, exposure time: 300 ms); (b) longitudinal comparison of the fluorescence area at different injection sites; (c) longitudinal comparison of PL intensity at different injection sites; (d) the linear correlation result between fluorescence intensity and exosome concentration at the injection site on day 0

4 QDs-ADSC-Exos a1-a7 QDs-ADSC-Exos PbS QDs 0 d 1 d 2 d 3 d 5 d 7 d NIR-II I II III IV 0.5mg/ml 0.1mg/ml 0.05mg/ml PbS QDs λex: 808 nm, : 300 ms b c d 0d

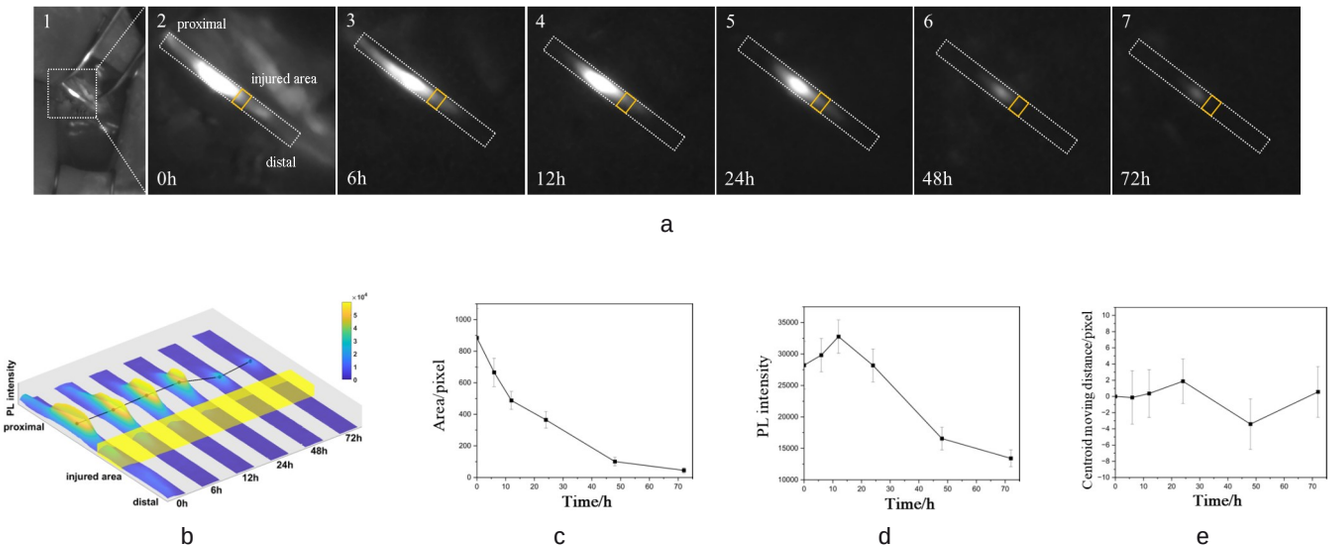

Fig. 5 In vivo monitoring of QDs-ADSC-Exos based on an NIR-II fluorescence imaging strategy in rat models of ischemic femoral nerve injury: (a1-a7) NIR-II fluorescence imaging at various time points (0 h, 6 h, 12 h, 24 h, 48 h, and 72 h) following the injection of 5 μl of 0.5 mg/ml QDs-ADSC-Exos near the proximal region of the femoral nerve in a rat model with femoral artery and vein ligation combined with femoral nerve injury (λex: 808 nm, exposure time: 300 ms); (b) schematic representation of fluorescence signal distribution at different time points, with black dots indicating the fluorescence centroid position and yellow boxes denoting the site of femoral nerve injury; (c) longitudinal comparison of the fluorescence area at different time points; (d) longitudinal comparison of PL intensity at different time points; (e) the centroid positions at different time points were determined, using the centroid position at 0h as the origin. The distances of centroid movement at 0h, 6h, 12h, 24h, 48h, and 72h were then calculated

5 QDs-ADSC-Exos a1-a7 5 ul 0.5 mg/ml QDs-ADSC-Exos 0 h 6 h 12 h 24 h 48 h 72 h NIR-II λex:808 nm, :300 ms ; b NIR-II ; c ; d ; d 0 h 0 h 6 h 12 h 24 h 48 h 72 h

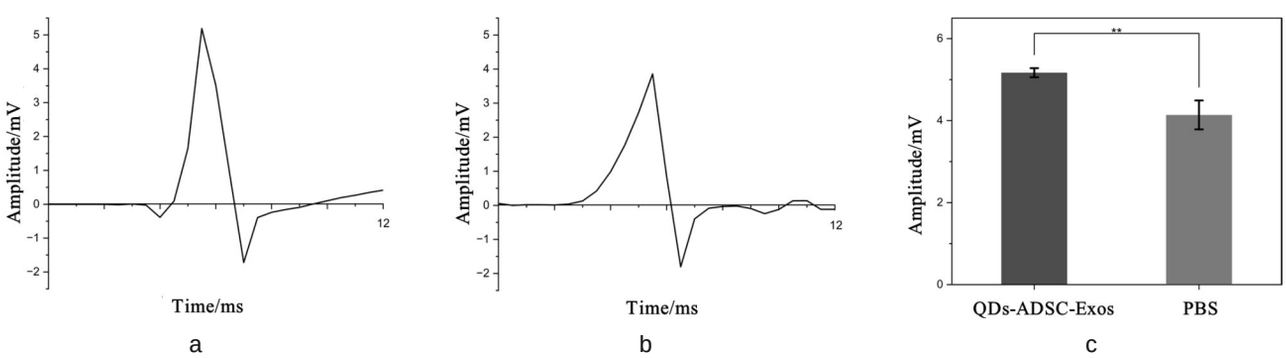

Fig. 6 CMAP of quadriceps muscle measured by electromyography: (a) rats with QDs-ADSC-Exos and (b) PBS injection at 28d post-injection; (c) histogram of signal intensity measured from (a) - (b)

6 CMAP (a) QDs-ADSC-Exos (b)PBS 28 (c) (a-b)

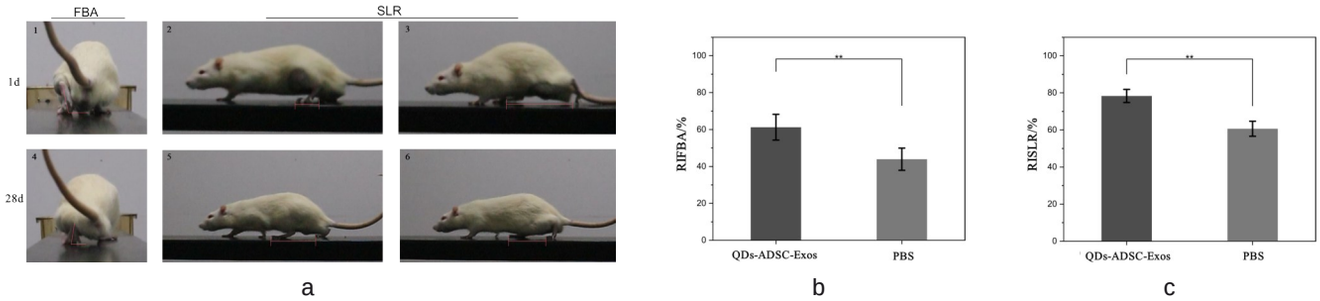

Fig. 7 Postoperative gait analysis in the rat model of ischemia femoral nerve injury: (a1) foot angle relative to the track during movement, (a2) ipsilateral step length, and (a3) contralateral step length at 1 day post-injury; (a4) foot angle relative to the track during movement, (a5) ipsilateral step length, and (a6) contralateral step length at 28 days post-injury. (b) RI FBA and (c) RI SLR comparisons between the QDs-ADSC-Exos and PBS groups at 28 days

7 1 (a1) (a2) (a3) 28 (a4) (a5) (a6) QDs-ADSC-Exos PBS 28 b RI FBA (c)RI SLR

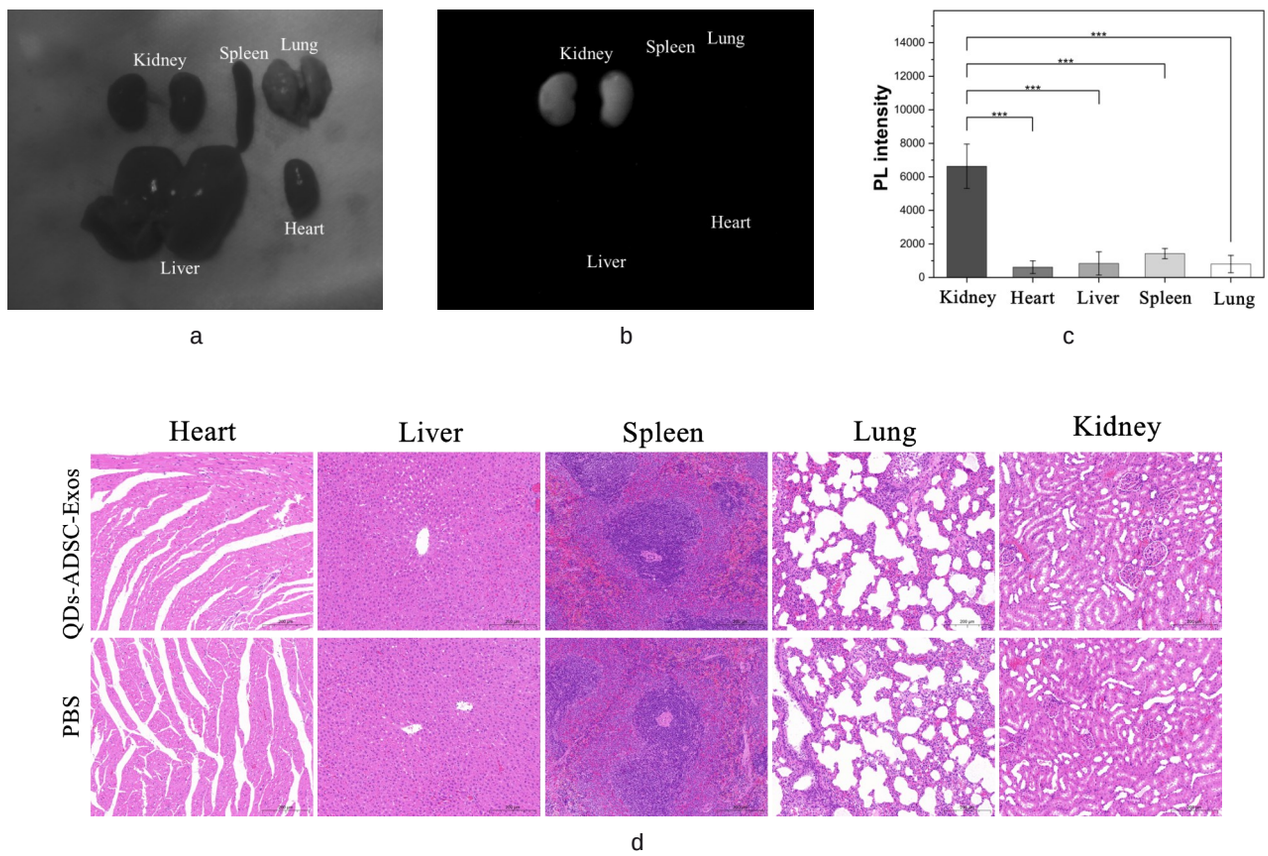

Fig. 8 Biocompatibility and Safety of QDs-ADSC-Exos: (a) bright field photograph and (b) NIR-II fluorescence image of the major organs harvested from the rats 28 days post-injection of QDs-ADSC-Exos; (c) quantification of NIR-II fluorescence signals from the organs shown in (b); (d) histological analysis with H&E staining of the major organs harvested from the the rats in the QDs-ADSC-Exos group and the PBS group at 28 days post-injection (scale bar = 100 μm).

8 QDs-ADSC-Exos (a) QDs-ADSC-Exos (b) NIR-II (c) NIR-II (d) 28 QDs-ADSC-Exos PBS HE (= 100 μm)