Background: Proximal right coronary artery (RCA) is reported as one of the frequent sites of stent fracture. We investigated fracture potentials of five drug-eluting-stents (DES) platforms using a novel accelerated durability tester which can apply an in-vivo simulated cyclically-bended load.

Methods: Bend-angles of RCA in end-systole and end-diastole were analyzed using frontal coronary angiographic data of 63 patients. The angle data classified in type-B according to ACC/AHA guideline were used to fabricate a RCA replica. Mechanical stiffness of the replica was adjusted to that of referenced human coronary arteries. Because the average angles in end-systole and end-diastole were 105° and 125°, the accelerated durability tests were performed under the identically cyclically-bended environment. Cyclic bend-load was exerted 1200 times per minute to the stent placed in RCA replica filled with 37°C-controlled phosphate buffered saline. Fracture potentials of Cypher 316L stainless steel (SS) stent (3.0mm×18mm, Cordis), Taxus Express2 SS stent (3.0mm×20mm, Boston Scientific), Liberte SS stent (3.0mm×20mm, Boston Scientific), Driver cobalt alloy stent (3.0×18mm, Medtronic), and Multi-Link Vision L605 cobalt chrome stent (3.0mm×18mm, Abbott) were investigated (n=6 each). Each stent was deployed at corresponding nominal pressure. All the tests were conducted for 10-years-equivalent duration except for incidence of stent-separation.

Results: Cypher stents were all fractured and completely-separated in 12±6 days equivalent (n=6). One Vision stent was completely-separated in 1020 days equivalent, while 5 Vision stents had no fracture. Driver and Liberte stents had no fracture. Although not completely separated, strut fractures were observed with Taxus Express2 stents, which were started in 178±310 days equivalent.

Conclusions: A novel test-platform to investigate fracture potentials of coronary stents was developed. The accelerated durability tests simulating cyclically-bended proximal RCA behavior elucidated different incidences of stent fracture for five DES platforms. These data demonstrated the importance of strut design for stent fracture.