We establish the well-posedness of a strongly damped semilinear wave equation equipped with nonlinear hyperbolic dynamic boundary conditions. Results are carried out with the presence of a parameter distinguishing whether the underlying operator is analytic, \( \alpha > 0 \), or only of Gevrey class, \( \alpha = 0 \). In both settings, we establish the existence of a global attractor and a weak exponential attractor under minimal assumptions on the nonlinear terms. The weak exponential attractor is a finite dimensional compact set in the weak energy phase space. Here, the existence of a weak exponential attractor insures the corresponding global attractors also possess finite fractal dimension in the weak topology; moreover, the dimension is independent of the perturbation parameter. The final result concerns the upper-semicontinuity of the family of global attractors as \( \alpha \to 0 \). (Received July 24, 2015)