Rapidly light-activated protein-based surgical glue

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Currently approved surgical tissue glues do not satisfy the requirements for ideal bioadhesives due to limited adhesion in wet conditions and severe cytotoxicity. Herein, we report a new light-activated, mussel protein-based bioadhesive (LAMBA) inspired by mussel adhesion and insect dityrosine photo-crosslinking chemistry. Because dityrosine crosslinks are known to confer mechanical and conformational stability and elasticity to insect structural protein including resilins of dragonfly wings, fibroins of silk worms, and locust cuticles, their introduction into tyrosine-rich (approximately 20 mol%) MAP may significantly increase structural support and adhesive properties as a very stable bridge. As a result, LAMBA exhibited substantially stronger bulk wet tissue adhesion than commercially available fibrin glue and good biocompatibility in both in vitro and in vivo studies. Besides, the easily tunable, light-activated crosslinking enabled an effective on-demand wound closure and facilitated wound healing. Based on these outstanding properties, LAMBA holds great potential as an ideal surgical tissue glue for diverse medical applications, including sutureless wound closures of skin and internal organs.