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Editorial

Foresight in Applications of Injectable Biomaterial Cement for Bone Regeneration

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Bone defects can be a major problem when treat fracture or when inserting the dental implant. Various regenerative procedures have been used for successful bone healing following trauma or extraction. Bone grafts and various substitutes together with a variety of techniques have been suggested.

The bone regeneration relies on the presence of distinct characteristics such as osteogenesis using mesenchymal stem cells, osteoinduction using growth factors, osteoconduction using grafting material as a scaffold and osteointegration in case of implant. Currently, there is a wide variety of bone and bone-graft alternatives that are commercially available for bone healing. They vary in their compositions, mechanisms of action, and special characteristics. Although several major progresses have been introduced in the area of bone regeneration. Bone grafts still have many limitations and research and development for grafting alternatives is still in progress.

In the interest of updating, bone material is present in different forms such as block, granules, powder, and injected paste. The injectable form is the most favourable because of its easy to handle and adjust to different forms. However, present injectable bone materials need either photo-imitator or heating to harden that may affect the surrounding tissue. In addition to, they need for open surgery to applicate. To overcome this issue, an injectable self-hardening material that is easily injected into irregularly shaped bone defects has to develop. Given these challenge, researching is necessary to discover an injectable material that has the characteristics of those bone materials, crosslink *in situ* (self-harden), and can be injected through a gap without the need for open surgery or any intervention. Consequently, produced minimally invasive injectable graft material.

A novel material that would rescue or ovoid the patients who exposed to bone fracture or need bone augmentation and implant from open surgery need to develop. In the past decade, our group has developed a modified form of biodegradable polymeric solution which is injectable polymer solutions, bond to a biological surface and cures to a solid (i.e. cross-linkable *in situ*) and porous structure without any intervention. It's produced based on a traditional scaffold fabrication technique to create a 3D porous structure. They have been reported as successful candidates for use as a bone tissue engineering scaffold *in vitro and in vivo*. However, there is no published study that looks into this and other injectable bone graft substitutes behaviour when they injected in closed defect *in vivo* and its potential use as a carrier for stem cell and recombinant bone morphogenetic protein.

Overall, an interesting candidate material with reliable properties for using as a scaffold for bone repair and reconstruction in closed defect has to be produced. It would have a major advantage in that it could be injected directly into the closed bone defect site and then set in situ at room temperature. From my point of view, comparable multicentre preclinical and clinical studies should be carried out in the future which in turn the results can be obtained and improved.

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