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Review on injectable hydrogel

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Abstract
Hydrogel have three-dimensional structure which is hydrogel is simply a hydrophilic polymeric network cross-linked in some fashion to form generate an elastic structure. Injectable hydrogel is technique in which active substance and biomaterials is injected into body fluid formation of situ soild hydrogel. Active substance such as drugs, Protein, genes, virus Injectable hydrogel are developed by photo cross linking polymerization by two types chemical and physical cross linking. Injectable hydrogel improve some properties such as good biocompatible, good biodegradable, controlled drugs release ability. Injectable hydrogel is injected into body fluid and formation of situ solid hydrogel.
Injectable hydrogel delivery variety of bimolecule to site of action. When hydrogel injected into the body fluid their will be contionus exchange of body fluid and hydrogel. Injectable hydrogel are used for tissue engineering, tissue regeneration and madical device.

Keywords: injectable hydrogel, chemical cross linking, physical cross linking, biocompatibility

Introduction

Hydrogel are three-dimensional network structure which drink large amount of water. Hydrogel are involved sample reaction between monomers and associated bond such as hydrogen bond, Vander walls bond. Hydrogel are a hydrophilic in nature which absorb water when it contact with body fluid and then it will be swell

Hydrogel can be used for delivery bioactive molecules which help for tissue regeneration. Injectable hydrogel is technique in which biomaterials is injected into body tissue and formation of situ solid hydrogel. Situ solid hydrogel means healthy cells are mixed with polymer and solutions and other bioactive materials and then injected into body body fluid. Injectable hydrogel are prepared by using hydrophilic monomer polymerization with existing ploy functional cross linking agent. Cross linking agent include glutaraldehyde (GTA) or genipin and enzymes. Injectable hydrogel are developed by chemical and physical cross linking. Injectable hydrogel are three-dimensional structure of which absorb water in biological fluid Natural polymer used in injectable hydrogel is collage and gelatin and polysaccharides such as alginate and agrose. Synthetic polymers are used in injectable hydrogel are vinyl alcohol polyethylene oxide and polyethylene glycol

Injectable hydrogel are based on situ formation. Injectable hydrogel is fill active substance in body fluid and then formation of situ solid hydrogel. Active substance include protein drug genes and virus. Injectable hydrogel can be used for good biocompatible, good biodegradable, minimal invasion, versatility, High drug release ability. It also used for control released and tissue engineering.

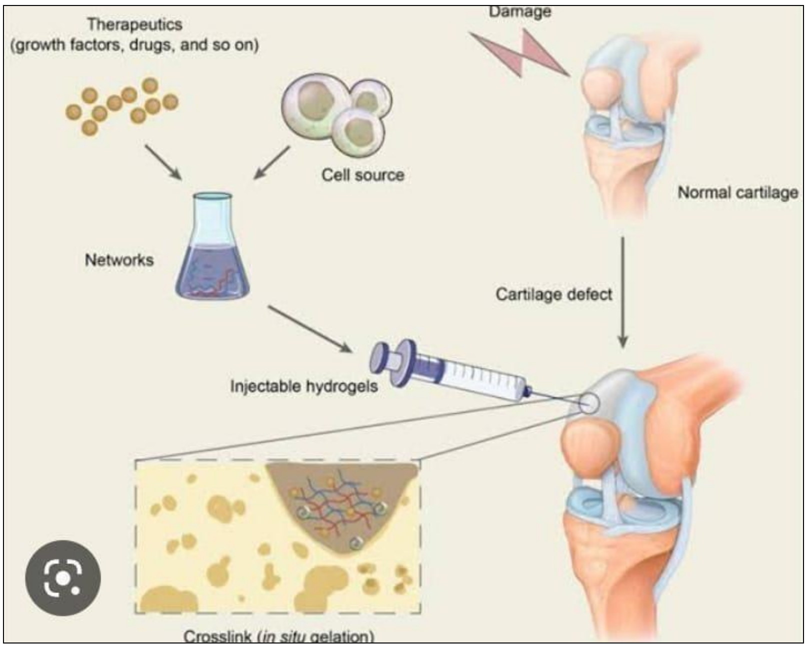

Fig 1

Mechanism of action

Injectable hydrogel when mixed with polymer and solutions and then injected into body fluid it will be swell and then continues exchange occurs between polymer and body fluid. Bio materials are release by ensured entrapped practical carried out by diffusion. When biomaterials is injected into body fluid formation situ solid hydrogel it absorb the water form the body fluid

Polymer used in preparation of injectable hydrogel is collage, gelatin, vinyl alcohol, polyethylene oxide and polyethylene glycol. Injectable hydrogel are developed by hydrophilic monomer with ployfunctional cross linking agent

Advantages of injectable hydrogel

Injectable hydrogel is improved some properties include good biocompatible and biodegradability

It have High drugs laoding capacity

It also controlled drug release ability

It also contains excellent cytocompatibility

It required minimal invasion surgery

It is suitable for thermolabile drugs

It easily control stimulus and trigger mechanism

Disadvantage of injectable hydrogel

Production cost of injectable hydrogel are high

It have poor mechanical strength

It as low reproducibility

It as lack of biocompatibility with some polymer

It required specialised service for non biodegradabile device

Development of injectable hydrogel

Injectable hydrogel developed by two methods

Injectable hydrogel developed by physical cross linking

Injectable hydrogel developed by physical cross linking - it is crosslinking reaction which is used for fabrication of hydrogel. It involves some interaction such as non covalent interaction, hydrophobic interaction, van der wals forced including dipole dipole interaction and Landon dispersion force. Injectable hydrogel developed by physical cross linking reaction

Physical cross linking reaction is occur between between a structural unit of polymer chain and structural unit of another chain. Physical cross-linking is the development of a bond between polymer chains through weak physical interactions. Physical hydrogel are reversible

For example

sodium aliginated gel are formed by when it contact with calcium ion and formation of ionic bond that are bond between alignate chain. Redox active injectable gel are develope for controlled local delivery of protein by the formation of ionic bond.

Physical injectable hydrogel are used for delivery of therapeutic agent and tissue engineering

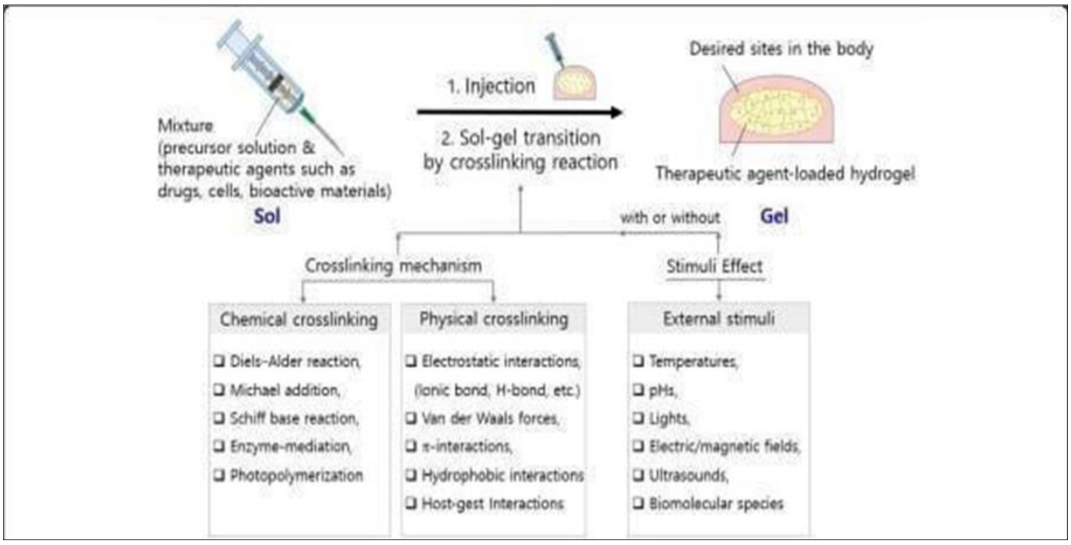

Fig 2

Injectable hydrogel are developed by chemical cross linking

Chemical cross linking are developed by chain growth polymerization, condensation polymerization and electronic beam polymerization. Chemical cross linking reaction involved covalent bond formation. Covalent bond are formed by mutul sharing of one and more pair of electrons between two atom crosslinked polymer are formed by adding of small cross linking molecule, polymer - polymer conjugated photosensitive agent or by enzyme catalysed reaction. Chemical cross linking agent are used for chemical crossing linking reaction Agents are glutaraldehyde or genipin and enzyme. Chemical cross linking consist some chemical reactions such as diels alder reaction, Michael reaction, schiffs base reaction or enzyme or photo mediated reaction. Diels alder reaction are reaction occurs between conjugated diene to an alkene or alkyne it formed cyclic rings structure. Michael addition reaction are the addition of conjugated nucleophile with electrons poor olefin to formed unsaturated carbonyl compound it required base catalysed and nucleophile catalysed. Schiff base addition reaction is involved addition of nucleophile and formation of imine bond from an amine and a carbonyl compound

Application of injectable hydrogel

Injectable hydrogel have many used for biomedical applications such as tissue engineering and tissue regeneration medicine drug and other therapeutic agent delivery and medical devices and etc

Tissue engineering

tissue engineering is technology in which damage tissue and damage organ can transplant with health tissue and organ. Injectable hydrogel are used for regeneration of tissue include bone, cartilage, alginate, fibre elastin, heparin and hyaluronic acid. Tissue engineering required some biomaterials which provides injectable hydrogel Hydrogel are fill vacant Space by bioactive substance or device which is regeneration of tissue

Medical device

Injectable hydrogel are also used as medical device Injectable bone filler categories into medical devices.

Injectable hydrogel used to deliver therapeutic agent

injectable hydrogel are also carriers the Protein, drug, gens and other biomolecules. It is help to deliver the drug at specific site and also help to regeneration of tissue. It also deliver the bioactive to specific site. Injectable hydrogel are also design for Target drugs delivery of therapeutic agent.

Wound healing

Hydrogel dressing have excellent antibacterial properties, bioadhesivness, good compatibility and biodegradability are used for wound healing it used to to control infection and improve angiogenesis Hydrogel have ability to convert NIR radiation, intensity time, cycling time. It increases temperature and inhibit bacteria growth effectively. Non particle of Cooper have good photothermal capability under NIR radiation. It's play important role in accelerating angiogenesis and propagation of for firbroblast

Drug therapy

Conventional drug delivery are associated with some undesirable effect such as drug absorption, rapid metabolism repeated dosing systemaic toxicities and degradation. Injectable hydrogel improve some properties such as degradability and physical properties which overcome the disadvantage. It improves biocompatibility, good syringe ability and stimuli to the enzyme which improves drug delivery System. Active substance such as genes peptides protein or even living cells and organ capsulated in hydrogel.

Cancer therapy

Systemic cytotoxicity is connected with the conventional chemotherapy of cancer injectable hydrogel control toxicity and ensure drug sustain release. injectable hydrogel are response to some stimuli include ph, temperature and immuno sensitivity which is used for cancer chemotherapy and gene therapy.

Some examples of of injectable Hydrogels TraceIT® and Space OAR®, are therapeutically used for cancerous cell it is protect the natural cell from damage by radiotherapy injectable hydrogel are used for the treatment of carcinomas and tumor

Conclusion

Review has focused on the different mechanisms of injectable hydrogel. This review article it covered injectable hydrogel developed by chemical and physical cross-linking system. It has covered variety of injectable hydrogel studies for drugs delivery system. It has also covered mechanism action of the Injectable hydrogel The major application of the Injectable hydrogel were covered This field required of noval hydrogel design with melodious properties.

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