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Personalised Medicine in Dentistry: Current Status and Future Possibilities

KEYWORDS

Drug Dosing

Drug Titration

Mesenchymal Stem Cells

Drug induced hypersensitivity

There is a new trend in medicine, called personalised medicine, which is essentially, customising healthcare and tailoring clinical practice to individual patients based on their genetic makeup and environmental and clinical profile. The Human Genome Project, for example redefined our understanding of the nature of the disease in terms of its relationship with the genes and the environment around us. Personalised medicine, as described in the literature is a combination of human genome, information technology, biotechnology, and nanotechnology to initiate preventive strategies and to provide treatment tailored to different individuals.

The medical profession recognised the importance of genomic information and has embraced and applied this concept in understanding the etiology of the disease and treating and preventing it. However, the dental profession has yet to accept and take advantage of this new technology. Genomics, which focuses on the interactions between all the genes in the genome and with environmental factors has the potential to revolutionise our understanding of oral health and disease. The application of genomics in the dental clinical setting and as useful aid for clinical decision making, requires an analysis of each individual patient's unique clinical, genetic, genomic, behavioural, and environmental information. The use of this information and application of the technology may enable early identification of disease and provide better prognosis and more effective treatment options for a variety of oral diseases. Oral diseases such as dental caries, periodontitis, orthodontics (e.g. malocclusion) and oral cancer are some of the well-researched diseases in the field of genetics and genomics.

As the field of genomics grows in terms of the increase in its applicability and feasibility, so will the knowledge of the genomic basis for oral diseases, which will then enable dentists to apply this technology in the diagnosis, prognosis, and treatment of various oral diseases. There is a potential for genomic technologies to transform oral health care practice, which in the future may result in a paradigm shift, from a reactive, treatment-based clinical approach to a more proactive, personalised-based preventive approach. The National Institute of Dental and Craniofacial Research (NIDCR)-supported National Practice-based Research Network (PBRN), in the USA is one example of an organisation that acts as a catalyst to link practicing dentists and researchers/scientists, to adopt new tools and technologies in the field of personalised medicine and/or oral health care.

However, personalised oral health care is not without its challenges, in both the developed and developing countries context. There are issues related to awareness and acceptance in the general public in terms of the risks and benefits of genome sequencing. In addition, there are a number of socio-ethical, legal, and professional barriers and scientific and technological know-how. The developing countries context provides additional challenges in addition to the above barriers mentioned, in terms of the feasibility, appropriateness and meaningfulness of personalised oral health care.

One of the strategies for the dental profession to overcome some of these barriers is to foster an environment of dialogue, engagement and education around personalised oral health care with the various stakeholders, including the policy makers, dental clinicians, researchers/scientists, dental educators and the general public. Personalised oral health care is here to stay and will rapidly evolve in the coming decades. It is therefore imperative for various stakeholders to engage and collaborate to provide the best possible oral health outcomes for the public in general.

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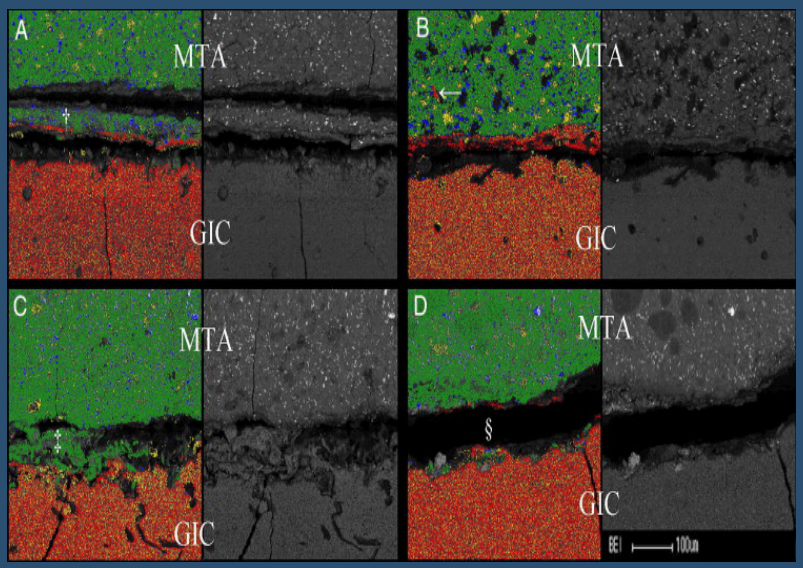
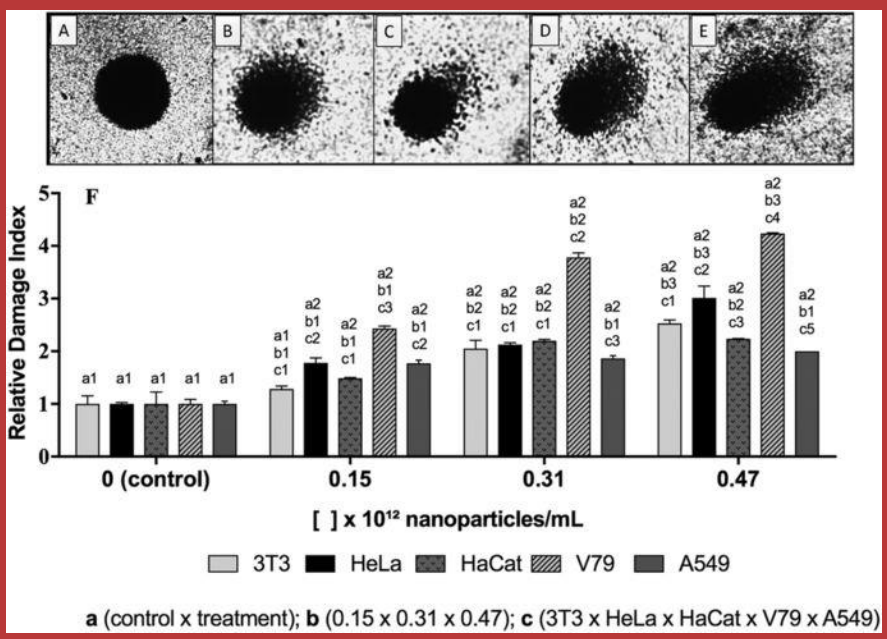
Dental Pulp Mesenchymal Stem Cells In And For Personalized Dentistry



In Restorative Dentistry, the protection of the dentin-pulp complex consists of the application of one or more layers of specific materials (varnishes, calcium hydroxide-based products, glass ionomer cements (GICs) and adhesive systems) between the restorative material and dental tissue, to avoid additional damage of pulp tissue caused by operative procedures, toxicity of restorative materials and bacteria penetration due to microleakage. GICs, invented and originally described by Wilson and Kent, are consisted of basic glass powder (calcium or strontium aluminofluorosilicate) and a water-soluble acidic polymer, such as polyacrylic acid.

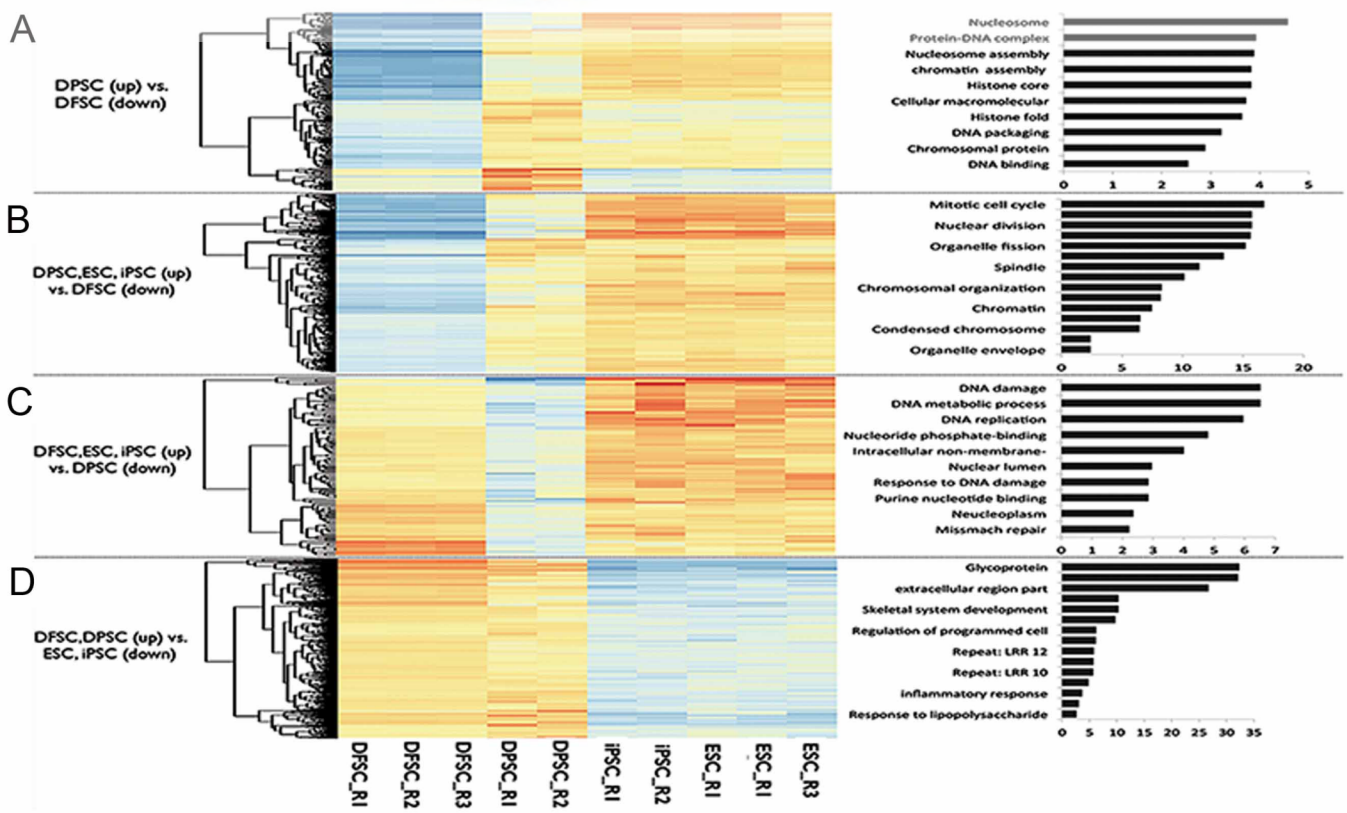
Responses to GICs differ among cell types, and thus, it is of great importance to thoroughly investigate the influence of these restorative materials on pulp stem cells that are source for dental tissue regeneration invivo.

Silver nanoparticles: Evaluation of DNA damage, toxicity and functional impairment in human mesenchymal stem cells



Silver nanoparticles (AgNPs) have been extensively studied for their antimicrobial properties, which provide an extensive applicability in dentistry.Due to a distinct lack of information on hazardous properties of AgNPs in human cells, their applications is not regulated in most of the indications. Human mesenchymal stem cells have been shown as established platforms to evaluate AgNP concentrations to be used in nanocomposites; implant coatings; pre-formulation with antimicrobial activity against cariogenic pathogens, periodontal biofilm, fungal pathogens and endodontic bacteria; and other applications such as treatment of oral cancer and local anesthesia not to induce DNA damage, cell death and functional impairment but present the powerful antimicrobial property.

Genomics of Tooth Derived Mesenchymal Stem Cells



Human Tooth derived Mesenchymal Stem Cells, their methods of isolation, culture expansion in the labs, large scale productions along with complete omics of genes expressed in the healthy human body is very well established science now after their discovery in 2003. The use of these stem cells is beyond their Regenerative Medicinal applications and gaining popularity in Personalized Dentistry, Palliative Medicine, Precision Medicine.

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