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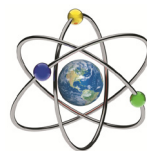


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- 13.00.00 Pedagogika fanlari
- 13.00.01 Pedagogika nazariyasi. Pedagogik ta'limotlar tarixi
- 13.00.02 Ta'lim va tarbiya nazariyasi va metodikasi (sohalar bo'yicha)
- 13.00.03 Maxsus pedagogika
- 13.00.04 Jismoniy tarbiya va sport mashg'ulotlari nazariyasi va metodikasi
- 13.00.05 Kasb-hunar ta'limi nazariyasi va metodikasi
- 13.00.06 Elektron ta'lim nazariyasi va metodikasi (ta'lim sohaları va bosqichlari bo'yicha)
- 13.00.07 Ta'limda menejment
- 13.00.08 Maktabgacha ta'lim va tarbiya nazariyasi va metodikasi
- 13.00.09 Ijtimoiy pedagogika
- 07.00.00 Tarix fanlari
- 19.00.00 Psixologiya fanlari
- 01.00.00 Fizika-matematika fanlari
- 02.00.00 Kimyo fanlari
- 03.00.00 Biologiya fanlari
- 09.00.00 Falsafa fanlari
- 10.00.00 Filologiya fanlari
- 11.00.00 Geografiya fanlari

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SUMMARY OF THE CELL ELEMENTS IN DENTAL SCIENCE

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Abstract: Biostimulants and proliferation inducers were the only substances that might influence tissue regeneration until recently. The discovery of primary stem cell cultivation techniques enabled novel approaches for tissue engineering and regenerative therapies in a number of medical professions, including dentistry.

Goal. This research aims to evaluate the current state of stem cell utilisation in dentistry, as well as its clinical limitations and scientific possibilities.

Materials and techniques. We exhaustively explored national dissertation catalogues, Medline, Ovid, HINARI, CINAHL, Embase, TRIP, and other international and regional databases for pertinent information. Keywords associated with "cell strain/stem cells," "dentistry," and "treatment" were tracked throughout a ten-year retroactive period. Following extensive relevance and evidence-level screening, 185 papers were selected for qualitative synthesis using content, bibliographic, and bibliometric analysis.

Findings from the study. Bibliometric data shows that between 2000 and 2010, there were far more literature reviews (79.5%) than original research articles (20.5%), with the USA, Japan, China, and Germany leading the way. In vitro experiments and animal models—typically immunocompromised mice—are used in the majority of original research. Important data suggests that adult mesenchymal stem cells isolated from dental pulp, exfoliated deciduous teeth, the apical papilla, and the periodontal ligament may develop into several lineages.

Key words: Rephrase sentence, Revert to original sentence, Copy sentence, Synonyms, papilla, papillae, pulp, the papilla.

Annotatsiya: Yaqin vaqtgacha to'qimalarning regeneratsiyasiga ta'sir ko'rsatishi mumkin bo'lgan yagona moddalar biostimulyatorlar va proliferatsiya induktorlari hisoblangan. Birlamchi ildiz hujayralarini kultivatsiya qilish usullarining kashf etilishi tibbiyotning bir qator yo'nalishlarida, jumladan stomatologiyada ham to'qima muhandisligi va regenerativ terapiyaning yangi yondashuvlarini yaratishga imkon berdi.

Maqsad. Mazkur tadqiqot stomatologiyada ildiz hujayralaridan foydalanishning hozirgi holatini, shuningdek, uning klinik cheklavlari va ilmiy imkoniyatlarini baholashga qaratilgan.

Materiallar va usullar. Tegishli ma'lumotlarni aniqlash maqsadida milliy dissertatsiyalar kataloglari, Medline, Ovid, HINARI, CINAHL, Embase, TRIP hamda boshqa xalqaro va mintaqaviy ma'lumotlar bazalari batafsil o'rganildi. "Cell strain/stem cells", "dentistry" va "treatment" kalit so'zlari o'n yillik retrospektiv davr davomida kuzatildi. Dolzarblik va dalillilik darajasi bo'yicha keng qamrovli saralashdan so'ng 185 ta maqola kontent, bibliografik va bibliometrik tahlil usullari yordamida sifat jihatidan sintez qilindi.

Tadqiqot natijalari. Bibliometrik ma'lumotlar shuni ko'rsatadiki, 2000–2010-yillar oralig'ida sharh maqolalari (79,5 %) original ilmiy maqolalarga (20,5 %) nisbatan ancha ko'p bo'lgan, bunda AQSH, Yaponiya, Xitoy va Germaniya yetakchilik qilgan. Original tadqiqotlarning aksariyati in vitro tajribalari va hayvonlar modellarida, odatda immuniteti susaytirilgan sichqonlarda amalga oshirilgan. Muhim ma'lumotlar shuni ko'rsatadiki, tish pulpasidan, tabiiy ravishda tushgan sut tishlaridan, apikal papilladan va periodontal bog'lamdan ajratib olingan katta yoshdagi mezenximal ildiz hujayralari bir necha hujayra yo'nalishlariga rivojlanishi mumkin.

Kalit so'zlar: Rephrase sentence, Revert to original sentence, Copy sentence, Synonyms, papilla, papillae, pulp, the papilla.

Аннотация: До недавнего времени биостимуляторы и индукторы пролиферации были единственными веществами, которые могли влиять на регенерацию тканей. Открытие методов культивирования первичных стволовых клеток позволило разработать новые подходы к тканевой инженерии и регенеративной терапии в ряде медицинских специальностей, включая стоматологию.

Цель. Настоящее исследование направлено на оценку современного состояния применения стволовых клеток в стоматологии, а также их клинических ограничений и научных возможностей.

Материалы и методы. Был проведён всесторонний анализ национальных каталогов диссертаций, баз данных Medline, Ovid, HINARI, CINAHL, Embase, TRIP, а также других международных и региональных баз данных для поиска соответствующей информации. Ключевые слова, связанные с “cell strain/stem cells”, “dentistry” и “treatment”, отслеживались в течение десятилетнего ретроспективного периода. После тщательного отбора по критериям релевантности и уровня доказательности 185 публикаций были отобраны для качественного синтеза с использованием контентного, библиографического и библиометрического анализа.

Результаты исследования. Библиометрические данные показывают, что в период с 2000 по 2010 год количество обзорных статей (79,5 %) значительно превышало количество оригинальных исследований (20,5 %), при этом лидирующие позиции занимали США, Япония, Китай и Германия. В большинстве оригинальных исследований использовались эксперименты *in vitro* и модели животных, как правило, иммунодефицитных мышей. Важные данные свидетельствуют о том, что взрослые мезенхимальные стволовые клетки, выделенные из пульпы зуба, выпавших молочных зубов, апикальной папиллы и периодонтальной связки, способны дифференцироваться в несколько клеточных линий.

Ключевые слова: Rephrase sentence, Revert to original sentence, Copy sentence, Synonyms, papilla, papillae, pulp, the papilla.

INTRODUCTION

Stem cells have demonstrated remarkable success in *de novo* vascularised dental pulp regeneration, dentin-like matrix deposition, and the expedited repair of craniofacial bone defects when seeded on biodegradable scaffolds (such as collagen sponges or D,L-lactide/glycolide matrices) or in conjunction with platelet-rich plasma. While bioengineering a complete prosthetic tooth for practical use is not yet feasible, advanced models that mimic tooth organogenesis utilising mesenchymal cells and embryonic mucosal epithelium show promise.

The use of stem cells in dentistry is still restricted to preclinical and exploratory laboratory phases, despite occasional speculative claims of rapid clinical application in professional and general sources. However, research suggests that dental somatic stem cells are a highly promising biological resource for regenerative endodontics, implantology, and maxillofacial reconstruction.

LITERATURE REVIEW

Until recently, the only option to affect the body's regeneration processes was through the use of biostimulants and proliferation inducers, while pathomorphologists and histologists continued to investigate cellular differentiation^[1, 2]. In 1960, Canadian scientists Ernest McCulloch and James Till developed primary cell culture procedures that created new therapeutic options. All multicellular organisms contain these cells, which are referred to as stem cells^[2]. In addition to self-renewing through cell division, these cells may differentiate into a wide range of specialised cell types. What distinguishes stem cells is their capacity to self-renew, undergo several cycles of cell division, and remain undifferentiated while retaining the ability to develop into any type of cell. This makes stem cells totipotent or pluripotent, although certain multipotent or even unipotent progenitors of specific cell lineages are also sometimes referred to as stem cells^[3].

Although their ability to differentiate is more limited than that of embryonic cells, somatic stem cells are multipotent or even unipotent. In regenerative medicine, these cells are now crucial^[3]. Since the use of adult stem cells in experimental research and clinical therapy is not associated with serious bioethical constraints, significant funding is allocated to the study of somatic stem cells, in contrast to embryonic stem cells^[3, 4].

Stem cells have the potential to significantly change existing treatment approaches for chronic disorders, including many that are believed to be incurable, according to researchers' experience^[3]. There is not enough data to support the clinical efficacy of most stem cell-based therapy techniques, which are mostly experimental. However, research so far suggests that cellular technologies have considerable potential for treating cardiovascular, neurodegenerative, and oncopathological diseases. Dental pathology is also included in this field^[3, 5]. However, articles on the use of stem cells in dentistry may sometimes have an overtly speculative tone, giving critics justification for unduly categorical assessments of the new method's potential in both science and practice^[6]. The purpose of this study was to assess the current state of the controversy surrounding stem cell utilisation in dentistry.



Because of their pluripotency and unlimited proliferation, embryonic stem cells have the potential to be exploited in regenerative medicine and tissue repair after diseases or accidents. Nevertheless, there is presently insufficient evidence to justify the extensive use of embryonic stem cells in medicine. This is not unexpected, as a number of countries have placed restrictions on both stem cell research and the procurement of new stem cell lines [3].

Somatic stem cells have been the subject of more investigation. Although their ability to differentiate is more limited than that of embryonic cells, somatic stem cells are multipotent or even unipotent. In regenerative medicine, these cells are now crucial [3]. Since the use of adult stem cells in experimental research and clinical therapy is not associated with serious bioethical constraints, significant funding is allocated to the study of somatic stem cells, in contrast to embryonic stem cells [3, 4].

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RESEARCH METHODOLOGY

The keywords "stem cells" (English), "Stammzellen" (German), "cellules souches" (French), "dentistry" (English), "Stomatologie" (German), and "treatment" (German) were used to search the Medline, Ovid, HINARI, CINAHL, Embase, and TRIP databases, as well as the dissertation catalogues of the Vernadsky National Library of Ukraine and the Russian State Medical Library over a 10-year retrospective period. A total of 185 papers were selected for further analysis using bibliographic and bibliometric techniques.

RESULTS AND DISCUSSION

Research findings. Only 54 original studies (20.5%) were published between 2000 and 2010, but the bibliometric evaluation showed that a significant majority of the selected publications were literature reviews (210 or 79.5%). The majority of the studies used laboratory models, with in vitro investigations predominating (31). The countries that advanced this field most rapidly were the USA, Japan, China, and Germany (106, 120, 9, and 17 publications, respectively).

The potential for regenerating vascularised dental pulp and creating new dentin on the residual dentinal walls within the root canal after canal therapy was assessed by Huang et al. (2010). Immunocompromised mice were used as the experimental laboratory model. After isolation and placement on a synthetic scaffold composed of D,L-lactide/glycolide inserted into tooth fragments, stem cells from the apical papilla and dental pulp were transplanted into previously depulped root canals. Subsequent examinations revealed that pulp-like tissue with well-developed blood vessels rapidly filled the canal space. In addition, deposits of dentin-like tissue containing CD105, alkaline phosphatase, and dentin and bone sialoproteins developed on the canal wall surfaces. Human mitochondrial antibodies reacted positively with the newly formed tissues, confirming their human origin. Therefore, regeneration of dental pulp de novo using stem cells capable of differentiating into odontoblast-like cells is considered feasible [7].

In a study by Nedel et al. (2009), dental pulp stem cells were isolated from the pulp tissue of permanent and deciduous teeth, as well as from the periodontal ligament. After transplantation, these dental pulp stem cells demonstrated the ability to form heterogeneous dentin complexes in the tissues of immunocompromised mice. These complexes contained ameloblasts, mesenchymal pulp cells, and a mechanical carrier. The researchers concluded that stem cells may be used in the future to replace the entire tooth.

The ability of human dental pulp stem cells for self-renewal, multilineage differentiation, and clonogenicity was reported in a study by Gronthos et al. (2002), although similar findings had been reported before the beginning of that decade. Stromal-like cells were re-established in cultures derived from primary stem cell transplants, and these cells were subsequently retransplanted into immunocompromised mice. The study demonstrated that stem cells could differentiate into neuron-like cells and adipocytes. In addition, several cell strains derived from a single-cell colony were evaluated for their odontogenic potential. In vivo, two-thirds of these strains generated significant amounts of heterotopic dentin deposits [9].

According to the reviews by Peng et al. (2009) and Morsczeck et al. (2008), multipotent mesenchymal stem cells, mainly derived from exfoliated deciduous teeth, dental pulp, the apical papilla, the dental follicle, the periodontal ligament, or bone marrow, show considerable promise for future applications in regenerative dentistry ^[10, 11]. Similarly, Tziafas and Kodonas (2010) recommended the use of stem cells derived from red bone marrow ^[13].

The potential applications of stem cells in implantology were the focus of Yamada et al. (2009) ^[14]. They demonstrated that the clinical outcomes of implantological therapy could be improved by incorporating mesenchymal stem cells derived from bone marrow, dental pulp, or deciduous teeth into an osteoimplant. Increased expression of the STRO-1, CD13, CD29, CD44, CD73, ALPL, Runx2, and BGLAP genes identified the stem cells in vitro. Stem cells and platelet-rich plasma were incorporated into a bone defect model in vivo. Eight and sixteen weeks after implantation, jaw specimens underwent histological and histomorphometric analyses. The results showed that the use of stem cells significantly accelerated bone tissue regeneration, promoted the formation of mature bone tissue in the defect area, and restored the vascular network.

According to Onyekwelu et al. (2007), at the current stage of technological development, it is technically difficult to artificially cultivate teeth for subsequent transplantation into patients with dentition abnormalities ^[15]. Individual reports from international organisations concerning Japanese scientists' use of cellular engineering to create a tooth during the winter of 2007 are not entirely accurate ^[16]; these reports describe only attempts to restore the primary morphological and structural components of a tooth under laboratory conditions. By combining epithelial and mesenchymal stem cells, the laboratory of Takahashi et al. (2010) demonstrated the potential to differentiate cloned oral mucosal epithelial cell lines into ameloblasts and regenerate tooth tissues ^[17]. At 18 days of gestation, when tooth morphogenesis is almost complete, the experiments were carried out on p53-deficient mouse embryos. Cell lines derived from mouse embryonic tissues were found to express oral mucosal epithelial markers (cytokeratin 14) by real-time PCR; however, ameloblast markers (amelogenin and ameloblastin) were absent during culture on plastic. The epithelial nature of the obtained cell lines was confirmed during incubation on a feeder layer or collagen gel. Tooth germs were subsequently generated using bioengineering techniques. They were produced using foetal mesenchymal tissue and epithelial cell lines and were implanted beneath the kidney capsule for two to three weeks. Five of the six cell lines regenerated into tooth-like calcified structures. The authors concluded that, at 18 days of gestation, embryonic oral mucosal epithelial tissues still retain the capacity to differentiate into ameloblasts. The Japanese researchers believe that this model has considerable potential for studies on tooth organogenesis and regeneration.

Otaki et al. (2007) demonstrated that dental pulp cells can proliferate and produce an extracellular matrix, which subsequently undergoes in vitro mineralisation ^[18]. After eight passages followed by subcutaneous implantation into immunocompromised mice, the researchers demonstrated that pulp cells could produce structural and morphological components of bone tissue rather than dentin. This finding suggests that pulp cells are mesenchymal stem cells because they frequently serve as progenitors of osteoblasts and odontoblasts. The authors proposed the use of dental pulp cells as a source of biological material for cellular bioengineering and regenerative medicine.

When assessing the potential of different odontogenic progenitor cells, Trubiani et al. (2006) favoured mesenchymal stem cells derived from the periodontal ligament or dental pulp. According to the authors, the main reason for the slow implementation of advanced cellular therapies in dentistry is the insufficient understanding of the molecular mechanisms underlying cellular differentiation ^[19].

The majority of studies published between 2000 and 2005 were exploratory in nature. They focused on identifying the best methods for cultivating and activating stem cells, as well as improving their application in clinical and laboratory settings ^[20, 21]. The most promising results were obtained when dental pulp stem cells were used together with a collagen sponge scaffold for the repair of bone tissue defects ^[22]. Until recently, however, scientific advances mainly focused on the use of autologous blood tissues and certain other unipotent cellular complexes ^[23, 24]. In particular, Ukrainian researchers used autologous bone marrow cells, blood cell suspensions, and skin fibroblasts applied to a Collapan biomatrix to repair jaw deformities and promote reparative bone regeneration. Additional evidence on the use of autologous tissues to accelerate the healing of bone defects in implantology and maxillofacial surgery has also been reported in the recent literature. Furthermore, Abukawa et al. (2009) demonstrated in a laboratory model that mandibular bone defects could be repaired using autologous tissue-engineered constructs derived from dental pulp and bone marrow ^[25]. High-resolution CT, together with histological and immunohistochemical analyses, confirmed the clinical effectiveness of this method.

CONCLUSION AND SUGGESTIONS

Therefore, the use of stem cells in dentistry is presently confined to exploratory laboratory investigations. Nonetheless, the accumulated experience already reveals that this innovative technique has a lot of promise.


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- 13.00.00 Pedagogika fanlari
 - 13.00.01 Pedagogika nazariyasi. Pedagogik ta'limotlar tarixi
 - 13.00.02 Ta'lim va tarbiya nazariyasi va metodikasi (sohalar bo'yicha)
 - 13.00.03 Maxsus pedagogika
 - 13.00.04 Jismoniy tarbiya va sport mashg'ulotlari nazariyasi va metodikasi
 - 13.00.05 Kasb-hunar ta'limi nazariyasi va metodikasi
 - 13.00.06 Elektron ta'lim nazariyasi va metodikasi (ta'lim sohaları va bosqichlari bo'yicha)
 - 13.00.07 Ta'limda menejment
 - 13.00.08 Maktabgacha ta'lim va tarbiya nazariyasi va metodikasi
 - 13.00.09 Ijtimoiy pedagogika
 - 07.00.00 Tarix fanlari
 - 19.00.00 Psixologiya fanlari
 - 01.00.00 Fizika-matematika fanlari
 - 02.00.00 Kimyo fanlari
 - 03.00.00 Biologiya fanlari
 - 09.00.00 Falsafa fanlari
 - 10.00.00 Filologiya fanlari
 - 11.00.00 Geografiya fanlari



AKTABGACHA VA AKTAB TA'LIMI

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