REVIEW ARTICLE

HISTOINTEGRATION AND OTHER TERMS IN DENTAL IMPLANTATION

DOI: 10.36740/WLek202203125

Vladislav A. Malanchuk[1], Vadym G. Klymentiev[2], Mykhailo S. Myroshnychenko[3]
[1] BOGOMOLETS NATIONAL MEDICAL UNIVERSITY, KYIV, UKRAINE
[2] EUROPEAN DENTAL CENTRE, KYIV, UKRAINE
[3] KHARKIV NATIONAL MEDICAL UNIVERSITY, KHARKIV, UKRAINE

ABSTRACT
The article describes biological and non-biological factors that affect the long-term stay of the implant in the bone under functional load, quality indicators of artificial teeth implantation. Instead of the term «osseointegration», the authors use the terms «histointegration» and «histodisintegration» defining them. The following concepts are used: time of histointegration achievement, histofunctional and histoaesthetic integration/disintegration, mechanical and biological stability/destability, integration/disintegration of implant and prosthetic structure, morphological and functional stability and destability of the implant.

KEY WORDS: primary and secondary histocontact, histointegration, histodisintegration, functional integration, implant stability, morphological and functional histostability, assessment of dental implantation

Wiad Lek. 2022;75(3):716-720

INTRODUCTION

Modern medicine does not always restore the lost shape and function of a human organ. In such cases, we use rehabilitation and replacement therapy, devices and tools that fully or partially compensate for the lost and improve the quality of life. For example, there is a well-known prosthetics method of lost parts of the face or teeth based on implants (artificial tooth root substitutes) which provides food intake, speech, facial aesthetics, etc. [1-7]. This method has objective features, as well as risks and complications [8-15].

Creation of artificial support for dentures involves installation of an implant through a protective layer of the epithelium, disrupting separation of the internal environment from the external, and causing major biological problems of the method. The situation is complicated by the traumatic implant placement, excessive functional load of the supporting tissues of the implantation area, mainly bones, improper prosthetics and quality of materials used, the patient's health, the body's response to intervention, other factors, etc. It was described the phenomenon [11, 16, 17] of a long-term stay of an implant in the bone under functional loading named «osseointegration». In 1971, it was showed a tight fit of bone tissue to the implant without the appearance of a connective tissue layer and maintaining this contact under functional load [18].

In 1982, the conference in Toronto recognized the effect of «osseointegration» [4, 15, 17, 19-21]. However, some researchers recognize non-physiology, risks of the method and the harm from implantation of artificial teeth [7].

Today, we distinguish the following clinical problems, diseases and conditions of peri-implant tissues: 1) healthy tissues around the implant, 2) near-implant mucositis, 3) periimplantitis, 4) deficiency of soft and hard tissues around the implant [10].

The scientists study various biological and non-biological aspects to solve these clinical problems of dental implants. Biological ones include the patient's health, bad habits, local clinical conditions, quantity, structure and properties of the bone available for implantation, the condition of the tissues adjacent to the implant, method of implant use, primary implant stability, the quality of contact bone support with the implant, integration type, etc. [22, 23].

Non-biological issues include implant geometry, its thread, surface and anti-rotation quality, implant-superstructure connection, implant-bone interaction biomechanics, prosthesis and tool quality, role of CAD (Computer-Aided Design) / CAE (Computer-Aided Engineering) / CAM (Computer-Aided Manufacturing) technologies, use of guides, aesthetics, etc. Various clinical, radiographic, laboratory, computer and other methods are used to study them [5, 10, 24].

However, despite the achievements in the development and implantation of artificial teeth in humans, some issues remain uncoordinated, mainly regarding the biological aspects of the method, terminology.

THE AIM

The purpose is to clarify some formulations in the implantation of artificial teeth and insufficiently known indicators of implant quality, to assess the clinical situation more accurately and improve the use of the method.

MATERIALS AND METHODS

A comparison of some definitions and indicators of the implantation quality of artificial teeth known from the literature with our own clinical experience in the use of intraosseous dental implants.

REVIEW AND DISCUSSION

The term «integration» means «combination» – that is, the process of combining parts into a whole one that is used by many researchers. The available data in the literature show that the recognized definition of the term «osseointegration» is not definitively agreed, because there are many important features of this phenomenon. Thus, it is difficult to take them all into account or only the main ones in one sentence [2, 5, 24-27].

Osseointegration is a type of integration of an implant into bone tissue by way of direct contact (or strong «fusion» of metal with bone without an intermediate connective tissue layer, although living and non-living do not grow together) and functional connection between them.

Recently, instead of the term "osseointegration", the term "biointegration" of dental implants has been used, about which there is no common opinion yet [6]. The International Congress of Oral Implantologists experts believe that «biointegration» is the binding of living tissue to the surface of biomaterial or implant, regardless of any mechanical locking mechanism (2021), using it to describe adhesion to implants coated with hydroxyapatite. This term also refers to various things / processes: part of the basis of «sustainable development of forest ecosystems of the middle Russian forest-steppe» [28], «a step-by-step lifestyle changing system for «reference health, energy, activity and longevity», describing medical implant materials, etc. [29, 30].

We use the terms of preservation or destruction of biological substances-structures in various fields of human activity. These are, for example: biological stability of wine – resistance to the microflora which damages its consumer qualities, its appearance, and determines its degree; biostability and bioresistance of implants made of metal, cellulose, lead, polyacetal, polyurethane, ionic materials for humans [30]. There are also known terms bioerosion, bioresorption [31], which can be considered as possible in the implantation of artificial teeth. Given the unresolved issues of biology in the implantation of artificial teeth, scientists are conducting seminars on this topic, which emphasizes the lack of a single point of view on complex biological processes in the tissues around dental implants [3, 30, 32-34].

Considering the above, it is advisable to cite another definition of the complex phenomenon «integration» of artificial teeth adopted by experts, without going into a discussion about its essence. But, taking into account that the «integration» of the implant takes place in living tissues (histo) – in the bone, periosteum, there is contact with the mucous membrane, it is «histointegration». In addition, the implantation of any foreign body in the body will be an individual response of systems and tissues, which must be taken into account. Moreover, the created system «bone-implant-prosthesis» must have long-term stability – the ability to maintain proper condition under the external influence, functional load. Adding prefix «bio» to this term does not give additional and clear meaning to the general term because the integration of dental implants can happen after its introduction only into living tissues, as implants are not inserted into inanimate tissues.

Thus, «histointegration» is a direct, long-lasting, anatomically and functionally capable stable connection without the intervention of scar tissue between the functionally rebuilt support tissue and the foreign body, able to withstand long-term functional load without uncompensated damage to the patient's body.

Histointegration (formerly – osseointegration) can occur in conditions of partially open foreign body, it is open histointegration (after a single, direct implantation into the cavity of a newly removed tooth, or after delayed implantation). Closed histointegration occurs in conditions of a completely closed foreign body tissues (after a two-stage implantation). Histointegration can be complete (over the entire surface of the intraosseous part of the foreign body, the implant), or incomplete (over part of the intraosseous surface of the implant).

By supporting tissue we mean bone tissue and tissues that have arisen after an increase in bone volume in the implantation area, using biological and artificial grafts / materials (also scar mineral conglomerates, augmentates – the term needs to be agreed on). The mucous membrane and periosteum as well as scar tissue can not bear the mechanical functional load due to their structure, function and properties.

After placement of the implant into the supporting bone between them, there must not be any distance, the primary implant-bone gap. But such a gap sometimes occurs in some places, and it is filled with blood, bone substitutes, otherwise there will be no primary stability of the implant and subsequent histointegration. The surface of the implant is in direct contact with bone tissue, its deformed and damaged elements, destroyed bone beams and cells, blood, and often bone substitutes. This is the primary direct histocontact of the implant with the supporting tissues and their substitutes [35, 36].

Given that the properties of the supporting bone on the intraosseous surface of the implant, as a rule, are not the same along the entire length of the primary histocontact, the state of the supporting bone structures may differ in the areas of implant-bone contact. This can be: 1) deformation within the deformation capacity of bone, its Ewing module. Here, it is possible to provide rather fast adaptation of a bone to loading with compensation of deformation and preservation of available bone structures; 2) in areas where the load will exceed the deformation capacity of the bone, overloaded bone structures should be rebuilt with the emergence of secondary direct histocontact, adapted to the presence of a foreign body and restored bone structures; 3) destroyed bone structures were eliminated and replaced by new bone structural elements in accordance with the presence of a foreign body in the bone. However, we do not exclude the risk of incomplete osteogenesis in some cases / areas.

In the process of creating secondary direct histocontact between the support bone and the implant surface by removing destroyed or deformed over the level of elasticity of bone beams and other bone elements, there is a temporary

secondary implant-bone gap width according to biological needs, which is then filled with new elements. This secondary implant-bone gap, given the artificially uneven surface of the implant, should probably be less than the length / thickness of the primary bone structure – one collagen fiber (which will preferably turn into a bone beam) or one bone beam at once, and be filled with regenerating components of tissue fluid (glycosaminoglycans, etc.).

Obviously, the bone beams can contact pointwise with the implant on their end surface or planar lengthwise, or both. As a result of the completed osteogenesis, new normal bone structures should be created, old bone beams should be rebuilt and functionally oriented according to the new function, to which a new mechanical load is applied. This relationship between the implant and the bone means histointegration in this area of secondary histocontact.

If the distance between the implant and the bone is greater than the length / thickness of the bone beam and is filled with a layer of connective tissue several collagen fibers thick, then fibrointegration will be in this area of tissue contact.

It is clear that there must also be integration, i.e. periosseointegration, between the periosteum and the implant. Thus, osseointegration, fibrointegration, periosseointegration (and mucosal contact) are possible components of implant histointegration.

Implantation is considered successful when about 70% of the intraosseous surface of the implant has direct contact with bone tissue, i.e, osseointegration, which should be sufficient for physiological functional load on the implant. The other 30% of the implant surface may have fibrointegration, which should not adversely affect the overall functional properties of the support created for the denture.

These up to 30% of surfaces with fibrointegration are usually located near the crown of the implant, which may be due to the following: 1) osteogenic regenerative potential of alveolar bone is extremely low in the alveolar process of both jaws, and here it is programmed for regeneration with the cheapest for the body way, with most of the scar tissue or resorption; 2) the bone of the alveolar sprout will be resorbed in some diseases, in tooth loss and integral tooth-periodontal-alveolar-mucous complex, which has a system of mutual biological support of its structures; 3) there are major inflammatory complications in this area in the form of peri-implant mucositis, periostitis, osteitis, osteomyelitis and bone lysis (the accepted term is periimplantitis).

We know that there are both benefits to the body during implantation, and the harm from it. Damage is a surgical trauma, implantation of the internal environment of the body with the external (oral cavity), improper quality of foreign body material, penetration of infection into the bone wound, postoperative inflammation of the periosteum and mucous membranes (possibly septic), the need to restrain the cuff mucous membrane from microbial aggression of oral fluid, mechanical influences and temperature fluxes from hot food, which are more transmitted through the implant to the bone without its protection by the mucous membrane. Implantation also produces negative microwave fluxes from the alveolar bone to the implant, which also adversely affects physiology of the tissues adjacent to the implant. This damage must be eliminated or compensated by the patient's body, which begins immediately after the surgery and lasts throughout the stay of the implant in the tissues.

Considering the above definition of the histointegration phenomenon, it is advisable to add some concepts on the implantation of artificial teeth.

Time to achieve implant histointegration lasts from the moment of implant placement to the moment of supporting tissues adaptation to it, prosthesis and new function, mastering of the patient's ability to use dentures (period of habituation). It can last for different periods, 2-6 months or more, depending on the regenerative properties of the body and supporting tissues, used grafts and bone substitutes, and indirectly indicates the regenerative properties of the supporting bone. The shorter this time, the better the reparative adaptive response of the supporting tissues (bones) to the implant, and so on.

Implant histointegration ensures its functional and aesthetic (soft tissue) integration. Functional integration provides the implant, the implant-prosthetic structure of the ability to eat while maintaining the histointegration of the implant and its position in the jaw. Accordingly, there may be functional disintegration – loss of the achieved functionality.

Aesthetic integration (tissue and prosthesis) involves the normal appearance of soft tissues, the condition of the marginal mucosa, interdental papillae («red» aesthetics), as well as the appropriate shape and color of dentures, etc. Accordingly, there may be aesthetic disintegration of the implant (tissue and prosthesis).

Histodisintegration of the implant is partial or complete loss of positive morphological, functional and aesthetic effects of varying degrees, up to the loss of the implant.

The stability (resistivity) of the implant can be primary (mechanical or mechanical stability) and secondary (tissue or histostability), in the tissues rebuilt under the implant and the new functional load of the tissues. Mechanical stability should be achieved even when installing the implant in the bone due to the tight contact of it with supporting tissues that are injured and strain stress in the mismatch of the diameter of the implant and implant bed, bone compression. This is a manifestation of the primary direct histocontact of the implant. Mechanical stability is required for further histointegration of the implant and the achievement of secondary histocontact, i.e. histostability, when the elastic deformation of the bone disappears and becomes compensated, and damage to bone structure is eliminated by reparative regeneration.

Histostability of the implant (morphological and functional) means the long-term preservation of the supporting and adjacent tissues condition, their anatomical position, the quality of the achieved morphological and functional integration.

Accordingly, the histodestability of the implant can be morphological (partial or complete loss of morphological qualities of the supporting tissues) and functional (usually secondary and depends on the quality of morphological stability, partial or complete).

Stability of the implant and prosthetic structure is the preservation of their acceptable clinical-morphological and functional-aesthetic condition for a long time. Accordingly, destability of the implant and prosthetic structure may occur due to the loss of their biological and mechanical qualities.

Mechanical stability (mechanical resistivity) of the implant and implant-prosthetic structure is a long-term preservation of the properties of supporting tissues, mechanical components and the entire structure (implant, screw, superstructure, prosthesis). Accordingly, there may be mechanical destability – partial or complete loss of viability of adjacent tissues and the destruction of the implant-prosthetic structure with its preservation or loss. In addition, there may be only aesthetic destability of the implant-prosthetic structure (for example, breaking off the edge of the artificial crown).

The data on the implantation of artificial teeth in the literature and our own experience in the use of dental implants since 1977 indicate the need for more careful study and accurate determination of the processes that the doctor deals with when replacing lost teeth and restoring their basic functions. The authors substantiate the reason for this in the article.

The definition of the term «histointegration» of the implant refers to the compensation or subcompensation of the patient's body for damage and risks caused by dental implants. It is harmful as it determines the body's response to implantation, disrupts the continuous protective epithelial layer of tissues and combines the internal environment of the body with the external.

There is also a description of the terms in the article: time of achieving histointegration of the implant, functional integration and disintegration, aesthetic integration and disintegration, morphological and functional stability of the implant, mechanical stability / destability of the implant and prosthetic structure, aesthetic destability. These terms and their meanings can be discussed.

The use of these terms, indicators of the state of the implant and implant-prosthetic structure, comparison of their state over time clarifies the description of the clinical picture, the state of the implant and implant-prosthetic structure, expands clinical diagnostic capabilities. This more fully informs the physician about the dynamics of the processes involved in periimplant tissues, implants and implant-prosthetic design, allows you to take the necessary measures in advance to influence the clinical situation, and can be useful in the clinic.

CONCLUSIONS

1. The authors use the term «histointegration» of a dental implant which describes the essence of this phenomenon more accurately.
2. The article gives a more complete definition of the term «histointegration» of a dental implant, indicating the effect of the implant on the human body.
3. Histointegration can be open and closed, partial and complete, stable and unstable according to the method of implantation.
4. The article describes clinical components of histointegration and histodisintegration effect, stability and destability of the implant, the state of the implant-prosthetic structure, the use of which clarifies the clinical picture, condition and outcome of dental implantation.
5. The given data, terms and their values increase the number of indicators for a more complete assessment of the quality of dental implants, compare different components of dental implants and increase their efficiency.

REFERENCES

1. Babov ED, Shuturminsky VG, Goncharenko EV, Gulyuk SA. Ed. Obukhovsky VA. Osnovy dentalnoj implantacii. Fundamentals of dental implantation. Odessa: First advertising and printing group: Publishing house and printing house "BMB", 2010. 112 p. (Ru)
2. Paraskevich VL. Dentalnaja implantologija. Dental implantology. Minsk: OOO Unipress, 2002. 368 p. (Ru)
3. Albrektsson T, Jansson T, Lekholm U. Osseointegrated dental implants. Dental Clinics of North America. 1986;30(1):151-174.
4. Jokstad A. Osseointegration and dental implants. Wiley-Blackwell, 2009. 419 p.
5. Misch CE. Contemporary implant dentistry. St. Louis : Mosby Elsevier, 2008. 1102 p.
6. Steigenga JT, al-Shammari KF, Nociti FH, Misch CE, Wang HL. Dental implant design and its relationship to long-term implant success. Implant Dent. 2003;12(4):306-317.
7. Warreth A, Ibieyou N, O'Leary RB, Cremonese M, Abdulrahim M. Dental implants: an overview. Dental Update. 2017; 44(7):596-620.
8. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. Int J Oral Maxillofac Implants. 1986;1:11-25.
9. Araujo MG, Lindhe J. Peri-implant health. J Clin Periodontol. 2018; 45 (Suppl 20): S230-S236.
10. Berglundh T, Armitage G, Araujo MG, Avila-Ortiz G, Blanco J, Camargo PM, Chen S, Cochran D, Derks J, Figuero E, Hämmerle CHF, Heitz-Mayfield LJA, Huynh-Ba G, Iacono V, Koo KT, Lambert F, McCauley L, Quirynen M, Renvert S, Salvi GE, Schwarz F, Tarnow D, Tomasi C, Wang HL, Zitzmann N. Peri-implant diseases and conditions: Consensus report of workgroup 4 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. J Clin Periodontol. 2018;45 Suppl 20:S286-S291.
11. Brånemark PI, Hansson BO, Adell R, Breine U, Lindström J, Hallén O, Ohman A. Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year period. Scand J Plast Reconstr Surg Suppl. 1977;16:1-132.
12. Burt B; Research, Science and Therapy Committee of the American Academy of Periodontology. Position paper: epidemiology of periodontal diseases. J Periodontol. 2005;76(8):1406-1419.
13. Jepsen S, Caton JG, Albandar JM, Bissada NF, Bouchard P, Cortellini P, Demirel K, de Sanctis M, Ercoli C, Fan J, Geurs NC, Hughes FJ, Jin L, Kantarci A, Lalla E, Madianos PN, Matthews D, McGuire MK, Mills MP, Preshaw PM, Reynolds MA, Sculean A, Susin C, West NX, Yamazaki K. Periodontal manifestations of systemic diseases and developmental and acquired conditions: Consensus report of workgroup 3 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. J Periodontol. 2018;89 Suppl 1:S237-S248.
14. Maheshwari R, Punia V, Khandelwal M, Sharma V, Malot S, Porwal A. Implan failure and management: a review. Int J Appl Dent Sci. 2018; 4(2): 293-298.

15. Papapanou PN, Sanz M, Buduneli N, Dietrich T, Feres M, Fine DH, Flemmig TF, Garcia R, Giannobile WV, Graziani F, Greenwell H, Herrera D, Kao RT, Kebschull M, Kinane DF, Kirkwood KL, Kocher T, Kornman KS, Kumar PS, Loos BG, Machtei E, Meng H, Mombelli A, Needleman I, Offenbacher S, Seymour GJ, Teles R, Tonetti MS. Periodontitis: Consensus report of workgroup 2 of the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions. J Periodontol. 2018;89 Suppl 1:S173-S182.
16. Brånemark PI, Adell R, Breine U, Hansson BO, Lindström J, Ohlsson A. Intra-osseous anchorage of dental prostheses. I. Experimental studies. Scand J Plast Reconstr Surg. 1969;3(2):81-100.
17. Branemark PI. Introduction to Osseointegration. Chicago, 1985. 29 p.
18. Pasqualini U. Gli impianti endo-ossei: richerche cliniche ed isto-anatomopatologiche [Endo-osseous implantations: clinical, histological and anatomic-pathological studies]. Dent Cadmos. 1971;39(6):886-890. [Italian].
19. Surov ON. Zubnoe protezirovanie na implantatah. Dental prosthetics on implants. – M.: Medicine, 1993. 208 p. (Ru)
20. Albrektsson T, Brånemark PI, Hansson HA, Lindström J. Osseointegrated titanium implants. Requirements for ensuring a long-lasting, direct bone-to-implant anchorage in man. Acta Orthop Scand. 1981;52(2):155-70.
21. Block MS. Color atlas of dental implant surgery. Second edition. Saunders Elsevier, 2007. 370 p.
22. De Bruyn H, Vandeweghe S, Ruyffelaert C, Cosyn J, Sennerby L. Radiographic evaluation of modern oral implants with emphasis on crestal bone level and relevance to peri-implant health. Periodontol 2000. 2013;62(1):256-270.
23. Hämmerle CHF, Tarnow D. The etiology of hard- and soft-tissue deficiencies at dental implants: a narrative review. J Clin Periodontol. 2018;45 Suppl 20:S267-S277.
24. Moy P, Romanos GE, Roccuzzo M: Loading protocols and biological response. In: Jockstad A ed. Osseointegration and dental implants. Wiley-Blackwell, 2009. p. 239-253.
25. Worthington F, Lang B, Lavelle V. Osteointegracija v stomatologii. Osseointegration in dentistry. Berlin: Quintessence, 1994. 126 p. (Ru)
26. Lysenok L. Osteointegracija: molekuljarnye, kletochnye mehanizmy. Osseointegration: molecular, cellular mechanisms. Clinical Implantology and Dentistry. 1997;1:48-59. (Ru)
27. Albrektsson T, Zarb GA. Current interpretations of the osseointegrated response: clinical significance. Int J Prosthodont. 1993;6(2):95-105.
28. Reutskaya VV, Arefiev YuF. Bioticheskaja integracija v lesnyh ekosistemah srednerusskoj lesostepi kak osnova ih ustojchivogo razvitija. Biotic integration in forest ecosystems of the Central Russian forest-steppe as the basis for their sustainable development. Bulletin of the Altai State Agrarian University. 2009;2(52):36-39. (Ru)
29. Sharma CP. Biointegration of Medical Implant Materials. 1st edition. CRC Press, 2020. 384 p.
30. Cochran DL, Schenk RK, Lussi A, Higginbottom FL, Buser D. Bone response to unloaded and loaded titanium implants with a sandblasted and acid-etched surface: a histometric study in the canine mandible. J Biomed Mater Res. 1998;40(1):1-11.
31. Derks J, Tomasi C. Peri-implant health and disease. A systematic review of current epidemiology. J Clin Periodontol. 2015;42 Suppl 16:S158-S171.
32. Barootchi S, Ravidà A, Tavelli L, Wang HL. Nonsurgical treatment for peri-implant mucositis: A systematic review and meta-analysis. Int J Oral Implantol (Berl). 2020;13(2):123-139.
33. Breine U, Johansson B, Roylance PJ, Roeckert H, Yoffey JM. Regeneration of bone marrow. A clinical and experimental study following removal of bone marrow by curettage. Acta Anat (Basel). 1964;59:1-46.
34. Steflik DE, Parr GR, Sisk AL, Lake FT, Hanes PJ, Berkery DJ, Brewer P. Osteoblast activity at the dental implant-bone interface: transmission electron microscopic and high voltage electron microscopic observations. J Periodontol. 1994;65(5):404-413.
35. Javed F, Romanos GE. The role of primary stability for successful immediate loading of dental implants. A literature review. J Dent. 2010;38(8):612-620.
36. Romanos GE, Javed F, Delgado-Ruiz RA, Calvo-Guirado JL. Peri-implant diseases: a review of treatment interventions. Dent Clin North Am. 2015;59(1):157-178.

ORCID and contributionship:
Vladislav A. Malanchuk: 0000-0001-8111-0436 [A, D]
Vadym G. Klymentiev: 0000-0001-5315-4220 [B]
Mykhailo S. Myroshnychenko: 0000-0002-6920-8374 [E, F]

Conflict of interests
The Authors declare no conflict of interests.

CORRESPONDING AUTHOR
Mykhailo S. Myroshnychenko
Kharkiv National Medical University
str. Svetlaya 27A, apt. 70, 61129, Kharkiv, Ukraine
tel: +380501699763, +380961033038
e-mail: msmyroshnychenko@ukr.net

Received: 17.08.2021
Accepted: 14.02.2022

A - Work concept and design, **B** – Data collection and analysis, **C** – Responsibility for statistical analysis, **D** – Writing the article, **E** – Critical review, **F** – Final approval of the article