

METHODS OF ADDITIONAL MOISTURE CONTROL IN THE PROXIMAL AND CERVICAL REGION

ELENA-CRISTINA MARCOV¹, MĂDĂLINA VIOLETA PERIEANU², RADU COSTEA³,
NARCIS MARCOV⁴, DANA CRISTINA BODNAR⁵, MIHAI BURLIBAȘA⁶, IULIANA BABIUC⁷,
RALUCA COSTEA⁸, TRAIAN BODNAR⁹, MĂDĂLINA MALIȚA¹⁰, CAMELIA IONESCU¹¹,
GABRIELA TĂNASE¹², AUGUSTIN MIHAI¹³, CORINA MARILENA CRISTACHE¹⁴,
IRINA ADRIANA BEURAN¹⁵

^{1,2,3,4,5,6,7,8,9,10,11,12,13,14,15} "Carol Davila" University of Medicine and Pharmacy Bucharest

Keywords: proximal, cervical, gingival, humidity, control

Abstract: The additional humidity control in the gingival sulcus is a very important step in the working protocol of direct proximal and cervical bonded restorations. An efficient removal of the gingival fluids is one of the keys to a correct restoration with good and lasting marginal sealing. The products should also have a gentle effect over the soft tissue, without persistent gingival retraction. The aim of this study is to evaluate the efficiency of the four methods for additional moisture control in the proximal and cervical gingival region. The four different categories of products (cord and 10% aluminum chloride hexahydrate solution, a paste with 15% aluminum chloride and kaolin clay, a 25% aluminum chloride gel and a vinyl polysiloxane paste with 15% ammonium aluminum sulfate) have different intrinsic features and specific instructions for use. The results show that the 25% aluminum chloride had the highest clinical efficiency.

INTRODUCTION

In direct restorative dentistry, proper moisture control in the gingival proximal and cervical region of the tooth can be achieved using mechanical, chemical, thermal and surgical methods. Some of their purposes are to satisfy the "needs" of the direct adherent restorations' protocols.

The presence of gingival liquid or/and blood may seriously interfere with the adhesion process. The main goals of these methods are to place the wet gingival tissues away from the gingival margins of the coronal lesions (or of the excavated cavities), to reduce the quantity of any liquid and to properly expose the areas to be restored.(1,2,3)

At the same time, these techniques and substances have to generate minimal and short inflammatory answer of the gingival tissue with proper recovery (seven to ten days) and they should not interfere with the systems of adhesion.(3,4,5)

The displacement (retraction) of the gingival margin can be made mechanically or chemically (through an astringent mechanism). The astringent effect is associated with a secondary haemostatic capacity which might be useful in certain clinical situations. The effect is reversible once the mechanic mean is removed, while the chemical substances produce a lasting gingival retraction (tens of minutes).(6,7,8)

The mechanical methods may imply the use of gingival cord, strips, different injectable pastes and materials (polyvinyl siloxane, self retracting impression systems) from specialized dispensers, rubber dam clamps (retainers), conformation systems and wedges.(2,5,8)

They primarily enlarge (widen) the gingival sulcus through a simple, mechanical displacement of the gingival margin, offering a good view over the region at work or they simply isolate the area from the moisture source (such as conformation systems). It is said that they provide a horizontal gingival retraction.(9,10,11,12)

The chemical methods imply the use of substances

with astringent or/and haemostatic effect. They enlarge (vertically and horizontally) the gingival sulcus through a biological mechanism. Nowadays, the frequently used products in restorative dentistry are the biologic fluid coagulants (Aluminum Sulfate compounds, Aluminum Chloride 5-25%) and styptics (Ferric Sulfate). For minimal side effects, they should be applied in gel or paste formulas, for three to ten minutes.(2,4,13,14)

For direct adherent restorations, the products with Aluminum Chloride are the best choice, inducing a proper gingival retraction with minimal side-effects.(1,15,16) They do not leave stains and the gingival recovery is decent. Any substance should be rinsed off very well, preferably, before etching.(1,2,17) It is advisable to use etch and rise adhesives. Some Aluminum Chloride products also incorporate kaolin in order to decrease the level of humidity in the area.(1,2,18,19,20,21)

The chemical substances can be used alone or in association with the mechanical methods. The chemo-mechanical methods are frequently use in restorative dentistry.(22-29)

PURPOSE

The purpose of this eighteen month study was to evaluate the efficiency of several methods of additional moisture control in the gingival sulcus during restorative dentistry procedures in the cervical and proximal areas.

The products were evaluated from two points of view: the quality of the clinical results and the intrinsic features of the products.

The clinical parameters were: the quality of the marginal sealing next to the free gingival margin and the gingival aspect at the end of the treatment, after fifteen days and after one month.

The intrinsic characteristic of the products were also

⁴Corresponding author: Narcis Marcov, No. 19, Plevnei Street, Sector 5, Bucharest, Romania, E-mail: mburlibasa@gmail.com Phone: +40723472632
Article received on 10.12.2018 and accepted for publication on 11.01.2019
ACTA MEDICA TRANSILVANICA March 2019;24(1):83-87

assessed by the practitioners from several aspects: time and degree of difficulty of the application protocol, time for rinse - off, degree of the gingival retraction, degree of fluids' removal from the gingival sulcus.

MATERIALS AND METHODS

Forty-four patients (twenty men and twenty-four women, age ranging from twenty-six to forty-three years old) with one hundred and sixty maxillary and mandibular teeth with primary proximal (eighty cases) and cervical caries (eighty cases) and healthy gingiva and periodontium were included in this study.

The protocol of the restorative treatment for every forty clinical cases (twenty proximal caries and twenty cervical caries) involved the use of a certain method for additional moisture control in the gingival sulcus.

The proximal and cervical caries had various degrees of loss of the hard tissue, with subgingival, equigingival and supragingival location of the gingival margin of the carious cavities.

The main steps of the working protocol followed in every clinical situation were developed along one or more treatment sessions:

First treatment session:

1. Teeth cleaning;
2. Clinical examination;
3. Paraclinical investigations (where necessary);
4. The filling in of the clinical observation sheet.

Second treatment session:

5. Analysis of the main characteristics of the selected clinical case to be treated;
6. Photo of the carious lesion and of the adjacent gingival margin or papillae;
7. Brief explanations (in understandable terms) to the patient regarding the clinical case and the main steps to be followed;
8. Tooth shade determination;
9. Occlusal contact recording (where necessary);
10. Pre-wedging (where necessary);
11. General moisture control and additional humidity control in the gingival sulcus using a selected association of methods;
12. Excavation of the infected carious tissue and cavity margins finishing;
13. Disinfection and protection of the exposed internal surfaces of the preparation;
14. Application of proximal conformation system and wedge (where necessary);
15. Application of the nano-hybrid composite using an anatomical layering technique;
16. Application of the cervical conformation system (where necessary);
17. Clinical (visual and tactile) evaluation and photo of the restoration and of the gingival margin at the end of the treatment session;
18. Paraclinical (radiological) evaluation of the proximal restorations;

Third treatment session:

19. "Fifteen day after" clinical evaluation and photo of the gingival margin;

Fourth treatment session:

20. "Three month after" clinical and paraclinical (where necessary) evaluations and photo of the restoration and of the gingival margin.

The clinical and radiological assessments were supervised and completed by two practitioners (observers).

The moisture control methods were various according to the features of the clinical cases. They associated the saliva ejector with Minidam (DMG) and absorbent pads, Optradam (Ivoclar Vivadent) and Mr.Thirsty (Zirc).

The four systems for additional gingival humidity control were: the retraction cord Roeko Comprecord (Coltene) soaked in Roeko Gingiva Liquid (Coltene), the gingival retraction paste Access Edge (Centrix), the retraction gel ViscoStat Clear (Ultradent) and the polyvinyl siloxane retraction system – GingiTrac (Centrix).

Roeko Comprecord (Coltene) is a retraction cord with polyester and polyamide yarns. The air-jet textured structure provides pliability and high absorbance. It has color coded different sizes (0-x fine, 1-fine, 2-medium, 3-thick), the first three sizes being used in this study.

Roeko Gingiva Liquid (Coltene) is a solution with 10% aluminum chloride hexahydrate. It provides gingival retraction through its astringent effect and it stops bleeding through its hemostatic effect (where necessary). The viscosity is low, so the liquid cannot stay in the gingival sulcus on its own. The cord soaked in the liquid is placed in the gingival sulcus with a retraction cord packer and left in place for one to three minutes. For direct bonded restorations, it is advisable to rinse off with water after removal.

Access Edge (Centrix) is a gingival retraction paste with 15% aluminum chloride and kaolin clay. The viscosity is high and, that is why, the paste stays in the sulcus on its own. It is presented in prefilled unit dose tubes with metallic single use dispensing tips.

The technique of application of this cordless method consists in the subgingival injection of the substance around the tooth. It dries out in two minutes, the kaolin absorbing the gingival liquid and expanding in the sulcus, providing horizontal displacement of the gingiva.

The aluminum chloride has the well-known astringent effect offering vertical and horizontal gingival retraction, with the additional hemostatic effect. The substance is rinsed off with water.

ViscoStat Clear (Ultradent) is a 25% aluminum chloride gel which is easily spread in the gingival sulcus from a single use syringe with a Dento-Infusor tip. It is viscous enough to stay in the sulcus on its own. However, it is frequently used in association with a retraction cord. It has a one to three minute action time, the substance being rinsed away with water. It has astringent and hemostatic effect. In this study, Viscostat Clear was used without retraction cord.

GingiTrac (Centrix) is an unusual retraction system for direct restorations protocols. However, this study intended to see if this cordless system indicated in prosthetics may be useful in direct restoring of proximal and cervical caries.

GingiTrac (Centrix) is a vinyl polysiloxane gingival retraction paste with 15% ammonium aluminum sulfate. The viscosity is medium, so the paste cannot stay on its own in the sulcus. Before using, a matrix of any high viscosity impression material should be made. GingiTrac is, either, dispensed into the matrix or syringed directly around the tooth. In any of the two situations, the matrix (empty or loaded) is applied again on the area of interest.

The patient is, then, asked to bite down for 3-5 minutes. A widened sulcus results after the removal of the matrix. The practitioner used latex-free gloves when using GingiTrac.

In this study, the use of every product implied a specific protocol, the instructions for use being carefully

CLINICAL ASPECTS

followed.

The correct accomplishment of the working protocol of every product was verified by the two observers. The observers were dentists with different degrees of medical training and clinical background in restorative dentistry.

The criteria of the three clinical evaluations for every clinical situation were as follows:

- the aspect and features of the marginal sealing (visual and tactile assessments);
- the general aspect of the restoration (visual assessment);
- the aspect of the gingival margin;
- the presence and measuring (where necessary) of the gingival retraction.

The practitioner who made the procedures also assessed the products used for additional humidity control in the gingival sulcus from several points of view as follows:

- comfort of the patient;
- the number of steps of the working protocol;
- total working-time;
- comfort and ease of application of the product;
- comfort and ease of the rinsing-off of the active substances;
- quantity of debris and presence of stains after removal;
- degree of fluids' removal from the gingival sulcus after one application.

An unconventional, simple statistical connection was made, in the end, among the clinical cases with good evaluation scores (proper marginal sealing, satisfying aspect of the gingival margin, lack of residual gingival retraction after ten days) and the products used for additional humidity control in the gingival sulcus.

Several statistical charts were also completed in order to establish the efficiency of the four methods and their intrinsic features.

RESULTS

The two observers evaluated the restorations in three different sessions according to the criteria from above assigning a score ranging from one to three. The meanings of the scores were as follows: 1–incorrect restoration (it needs reparation); 2–incorrect restoration (it needs retreatment); 3–correct restoration.

Figure no. 1. The efficiency of the four products in the protocol of direct proximal restorations

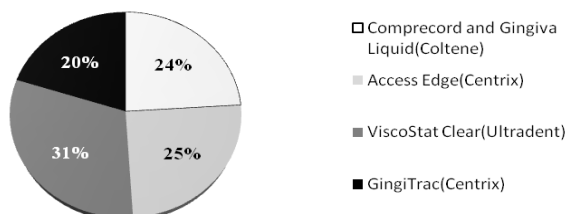
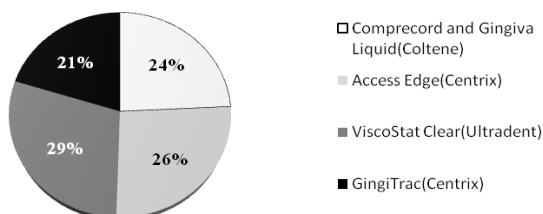


Figure no. 2. The efficiency of the four products in the protocol of direct cervical restorations



After recording all the results, the overall efficiency of the four methods for gingival moisture control was calculated separately for the proximal (figure no. 1) and cervical situations (figure no. 2).

The two observers also evaluated the gingival margin assigning a score ranging from 1 to 3: 1 – presence of erythema and edema; 2 – presence of erythema; 3 – normal. The aspect of the gingival margin after ten days was considered significant for both categories of restorations (figure no. 3, figure no. 4).

Figure no. 3. “Ten day after” aspect of the gingiva: 1 - ViscoStat; 2 - GingiTTrac; 3 - Access Edge; 4 - Comprecord and Gingiva Liquid

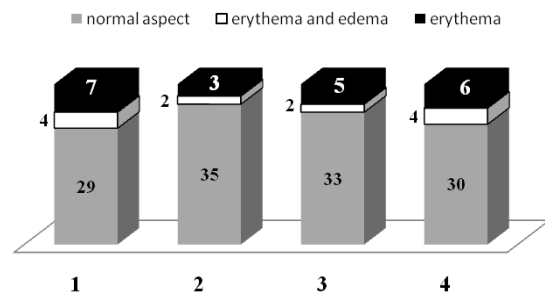
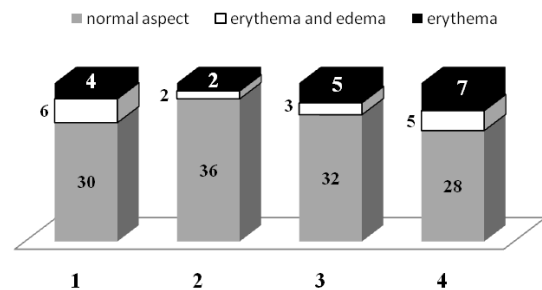


Figure no. 4. Ten day after aspect of the gingiva: 1 - ViscoStat; 2 - GingiTTrac; 3 - Access Edge; 4 - Comprecord and Gingiva Liquid

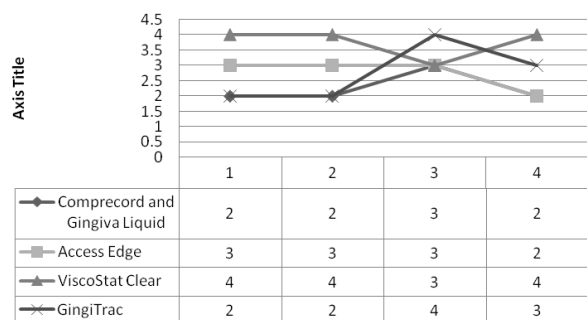


The practitioner evaluated the four methods from several points of view. A score ranging from 1 to 4 was assigned to every product in every clinical situation. The meanings of the scores were as follows:

1- none; 2- satisfactory; 3 – good; 4 – very good (figure no. 5).

Figure no. 5. The features of the products: 1 - fast working protocol; 2 – easy application; 3 – easy rinsing off; 4 – efficient effect.

The practitioner's evaluation of the four methods



DISCUSSIONS

ViscoStat Clear (Ultradent) offered an efficient gingival displacement, being able to provide a good moisture control in the gingival sulcus. The practitioner's scores regarding the working-protocol were high, the only concern being related to the rinsing off protocol. This substance has to be very well rinsed away during several steps which may take extra time. The healing of the gingival margin took some time, its aspect presenting, after ten days, in several few cases, erythema and, even, edema.

Access Edge (Centrix) has an easy working-protocol, the humidity control being, unfortunately, quite inefficient because of the poor displacement of the gingival edge. The fluids from the sulcus were additionally removed with the aid of the kaolin-clay. The gingival aspect after ten days was quite good, in most of the cases.

Roeko Comprecord (Coltene) and Roeko Gingiva Liquid (Coltene) offer a satisfactory gingival humidity control, the application with the cord packer rising difficulties and involving, unfortunately, a long period of time. Most of the cases presented an erythematous and edematous gingival margin or papillae after ten days from the treatment session.

The use of GingiTrac (Centrix) in the protocol of direct restorations was unconventional, the results being quite surprising. The gingival widening was quite efficient, the gingival humidity control being satisfactory but for short term. The protocol implied time-consuming steps with different degrees of difficulty. The aspect of the gingival margin was very good after ten days from the moment of treatment.

In every clinical situation, the anatomical characteristics of the gingival sulcus played a very important part in the quality of the outcome of the procedure.

Even if the aim of this study was to evaluate the clinical efficiency of several methods for gingival humidity control, there are lots of other reasons why direct bonded restorations may be incorrect. So, it is not necessary for the incorrect restorations to need reparation or replacement because of a single reason: the gingival retraction system.

The steps for every clinical category need to be thoroughly followed in order to avoid any unwanted result. For example, the use of an adequate conformation system and of a suitable wedge is essential in the working protocol of restoring the proximal caries.

These systems also play a very important part in controlling the degree of humidity of the gingival wall and in the areas around.

CONCLUSIONS

A proper removal of the gingival liquids is essential for obtaining high-quality proximal and cervical direct bonded restorations.

The main purposes of a good gingival moisture control system are an efficient gingival displacement and the presence of different additional substances which may absorb the gingival crevicular fluid. The horizontal and vertical gingival retraction should be significant and should last long enough in order to offer sufficient time to the following direct restoring steps.

Although the results did not indicate major differences among the products, a leader board according to their clinical efficacy has been accomplished.

ViscoStat Clear (Ultradent) was the most efficient product, the gingival humidity control being well controlled. The working-protocol was time friendly, the effects over the gingival margin being acceptable and also depending on the features of the clinical case.

Even if this product was used with a cordless technique in this study, the gingival displacement was satisfying, the additional gingival moisture control, being, in this way, quite good.

The sequence of the other products according to the descending clinical efficiency and the characteristics of the working protocol were as follows: Access Edge (Centrix), Roeko Comprecord (Coltene) & Roeko Gingiva Liquid (Coltene)(with very close results), GingiTrac (Centrix).

Unfortunately, the old conclusion still stands, this study proving that the most efficient product has the highest level of active substance which also has the most side effects over the gingival margin.

Nevertheless, the good judgement and clinical skills of the practitioner, as well as the correct use of these substances may lead, finally, to efficient humidity control in the gingival area, minimal damage to the gingival margin and good direct bonded restorations.

Acknowledgement:

In this article, all the authors have equal contributions.

REFERENCES

1. Strassler HE, Boksman L. Tissue management, gingival retraction and hemostasis. Oral Health. 2011;101:35.
2. Marcov EC, Marcov N, et al. Comparison of several proximal conformation systems' clinical efficiency in restorative dentistry. Acta Medica Transilvanica. 2016;21(3):84-87.
3. Marcov EC. Protocol de restaurare aderentă directă a leziunilor carioase simple proximale din zona laterală. In: Pădure L, Marcov EC, Burcea CC, Lupușoru M, editors. Actualități în asistența medicală, vol. 4, 2013, Editura Ars Docendi, București; 2013. p. 19-54.
4. Marcov EC. Manual de odontoterapie restauratoare, vol.II. Instrumentarul utilizat în odontoterapie restauratoare. Editura Ars Docendi, București; 2012.
5. Summitt JB, Robbins JW, Schwartz RS, dos Santos J. Fundamentals of operative dentistry: A contemporary approach; 3rd ed. University of Michigan: Quintessence Pub; 2006.
6. Bodnar D, Marcov N. Patologia coletului dentar - aspecte clinice și terapeutice. Editura Ars Docendi, București; 2012.
7. Heymann H, Swift EJ, Ritter AV, Sturdevant CM. Sturdevant's Art and Science of Operative Dentistry; 2013, 6th ed. St. Louis, MO: Elsevier/Mosby; 2013.
8. Tarighi P, Khoroushi M. A review on common chemical hemostatic agents in restorative dentistry. Dent Res J (Isfahan). 2014;11(4):423-428.
9. Gupta A, Prithviraj DR, Gupta D, Shruti DP. Clinical evaluation of three new gingival retraction systems: A research report. J Indian Prosthodont Soc. 2013;13(1):36-42.
10. Shrivastava KJ, Bhoyar A, Agarwal S. Shrivastava S, Parlani S, Murthy V. Comparative clinical efficacy evaluation of three gingival displacement systems. J Nat Sci Biol Med. 2015 Aug; 6 (Suppl 1):S53-7.
11. Al Hamad KQ, Azar WZ, Alwaeli HA, Said KN. A clinical study on the effects of cordless and conventional retraction techniques on the gingival and periodontal health. J Clin Periodontol. 2008;35:1053-8.
12. Gupta GK, Rao H, Garg P, Kumar R, Sharma A, Sachdeva H. Astringents in dentistry: A review. Asian J Pharm Health Sci. 2012;2:428-2.
13. Bernades K de O, Hilgert LA, Ribeiro AP, Garcia FC,

- Pereira PN. The influence of hemostatic agents on dentin and enamel surfaces and dental bonding: a systematic review. *J Am Dent Assoc.* 2014;145(11):1120-8.
14. Chandra S, Singh A, Gupta KK, Chandra C, Arora V. Effect of gingival displacement cord and cordless systems on the closure, displacement, and inflammation of the gingival crevice. *J Prosthet Dent.* 2016;115(2):177-82.
15. Burlibaşa M, Şteţiu AA, et al. Finite element method analysis of the stress induced upon the dental implant by the mastication process. *Romanian Biotechnological Letters.* 2017;22(4):12706-12714.
16. Marcov EC., Marcov N. Electron microscopy validation of ICDAS codes 5 and 6 for proximal caries. *Romanian Journal of Oral Rehabilitation.* 2013;5(3):92-96.
17. Şteţiu AA, Burlibaşa M, et al. FEM analysis of masticatory induced stresses over surrounding tissues of dental implant. *Romanian Biotechnological Letters*, Received for publication, January, 6, 2018. Accepted, May, 12, 2018.
18. Sfarghiu LG, Oancea L, Liţescu R, Burlibaşa M, et al. The influence of disinfectants incorporation on die stone linear expansion. *Romanian Biotechnological Letters.* 2016;21(3):11585-11590.
19. Marcov N, Marcov EC, Burlibaşa M, et al. Evaluation of ICDAS II implementation in dental student's educational process. A 6-year study. *Acta Medica Transilvanica.* 2016;21(3):92-95.
20. Burlibaşa L, Zarnescu O. In vivo effects of Trichostatin A–A histone deacetylase inhibitor–On chromatin remodeling during *Triturus cristatus* spermatogenesis. *Animal reproduction science.* 2013;142(1-2):89-99.
21. Gavrilă L, Mircea L. Chromatin and chromosomal fine structure in spermatogenesis of some species of amphibians. *Zygote.* 2001;9(3):183-192.
22. Şteţiu AA, Oleksik M, Oleksik V, Şteţiu M, Burlibaşa M. Mechanical behavior of composite materials for dental obturations. *Romanian Biotechnological Letters.* 2013;18(4):8528-8538.
23. Bodnar DC, Pantea M, Bodnar T, Burlibaşa M, Dumitru SG, Cristache CM. Patologia mucoasei orale la pacienţii vârstnici-studiu clinic-statistic. *Acta Medica Transilvanica.* 2012;2(2):56-60.
24. Cristache CM, Burlibaşa M, Cristache G, Drafta S, Popovici IA, Iliescu AA, Zisi S, Burlibaşa L. Zirconia and its biomedical applications. *Metalurgia International.* 2011;16(7):18-23.
25. Bodnar DC, Dimova C, Bodnar T, Cristache CM, Burlibaşa M, et al. Dental management of patient with psychiatric disorders. *Modern Medicine.* 2010;17(10):538-543.
26. Lazăr V, Chifiriuc C, Bucur M, Burlibaşa M, Sfeatcu R, Stanciu G, Savu B, Trăistaru T, Cernat R, Suciu I. Investigation of dental-plaque formers biofilms by optic and confocal laser scanning microscopy and microbiological tool. *Revista Medico-Chirurgicală a Societăţii de Medici şi Naturalişti din Iaşi.* 2008;112(3):812-820.
27. Burlibaşa M, Muntianu LAS, Tănase G, Bucur MB, Comes CA, Ionescu CA. Study on microbial contamination of biomaterials in medical practice. *Metalurgia International.* 2010;15:163-166.
28. Burlibaşa M, Cuculescu M, Tănase G, Mihai A, Temelcea A, Popa E. Dental alloys of prosthetic use - A retrospective of their use in Romania. *Metalurgia International.* 2009;14:51-53.
29. Burlibaşa L, Gavrilă L. Developmental epigenetics: roles in embryonic development, in *Nutrition in Epigenetics* (eds. Niculescu MD, Haggarty P). Ch. 6, Wiley-Blackwell Publishing; 2011. p. 105-126.
30. Burlibaşa L, Gavrilă L. Developmental epigenetics: roles in embryonic development, in *Nutrition in Epigenetics* (eds.