DIGITAL ANALYSIS OF TEETH TREATED WITH THE HALL TECHNIQUE

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ABSTRACT

INTRODUCTION: The information about digital examination provided by the scientific literature is quite insufficient. Therefore, digital examination of the occlusion is an object of analysis not only in Bulgaria but in other countries as well. No evidence for digital occlusal analysis on Hall-crowned teeth was found in the prosthetic part of the pediatric dentistry.

AIM: The aim of this article is to conduct a study on the occlusal balance with T-scan after treatment with preformed metal crowns (PMCs) using the Hall technique.

MATERIALS AND METHODS: Object of the clinical study were 50 crowned primary teeth. Unit of observation with the T-scan 8 system were occlusal articulation relationships in primary and early mixed dentition after the Hall technique.

RESULTS: The results confirmed equal occlusal relationships in both sides – the crowned teeth compared with the symmetrical natural teeth. The occlusal contacts were with a similar value of the summary masticatory force compared with the control group of natural teeth.

CONCLUSION: The received data confirmed that the restoration of decayed teeth with preformed metal crowns maintained the occlusal harmony in the dentition.

Keywords: *T-scan, PMCs, Hall technique, primary teeth*

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INTRODUCTION

The digital examination of the occlusion is object of analysis for the foreign (1-7) as well as the Bulgarian studies. The T-scan system use allows fast and accurate identification of the masticatory force distribution on the occlusal contact points in the maximal intercuspidation (8,9,10) and in dynamics (2,11,12), as it gives information about the time parameter. In Bulgaria, Krysteva (13,14) was the first to

publish scientific evidence about the T-scan system concept of work. A scientific contribution in the examination of the masticatory pressure with the assistance of the digital analysis was marked by the scientific researches of Kalychev (15,16). He developed a computer program for determination of the occlusal forces, the surface of the contact points, and the occlusal pressure using an additional software in combination with the T-scan II system.

In 2013, Djorova and Andreeva (17) described a method of examination of the occlusal relations with T-scan in the final phase of the orthodontic treatment of different malformations (17,18,19).

For the first time in Bulgaria, in 2014, Dimova-Gabrovska (20) (group E) conducted a study with a T-scan III system in patients with bruxism and bruxomania. Based on methodological sequence of examining the occlusal-articulation relationships with an articulation paper and the T-scan were registered the interdental relations in patients with bruxism and patients with normal occlusion assessed on the Andrews scale without functional pathology of the masticatory apparatus. The registered results were analyzed in the sequence - Algorithm for Analysis of the Occlusion and the Articulation in Patients with Bruxism and Bruxomania by Dimova, including analysis of different parameters of the stability of the occlusion in the maximal intercuspidation (MIP); of the articulation relations of the protrusion, of the left and right lateral occlusion and the occlusal relations in central condylar position.

The literary reference did not show evidence on the opportunities of the digital occlusal analysis in the prosthetic treatment in pediatric dentistry, and the treatment with preformed metal crowns (PMCs) using the Hall technique in particular.

AIM

The aim of this article is to conduct examination of the occlusal balance with T-scan after treatment with PMCs using the Hall technique.

MATERIALS AND METHODS

Object of the clinical study were 50 crowned teeth. Unit of observation were occlusal articulation relationships in primary and early mixed dentition after the Hall technique. A digital analysis of the occlusal articulation relationships with the T-scan 8 system for an evaluation of the occlusal harmony in the dentition one year after the crown application.

RESULTS

The insufficient literature data regarding the occlusal characteristics of the Hall crowned teeth was the reason for the addition of digital occlusal analysis with the T-scan 8 system and verification of the occlusion.

The results confirmed that the restoration with PMCs of teeth affected by caries did not disturb the occlusal relations. The occlusal contacts accomplished between PMCs and the natural antagonists were characterized by a similar value of the full masticatory force compared to that of the symmetrical

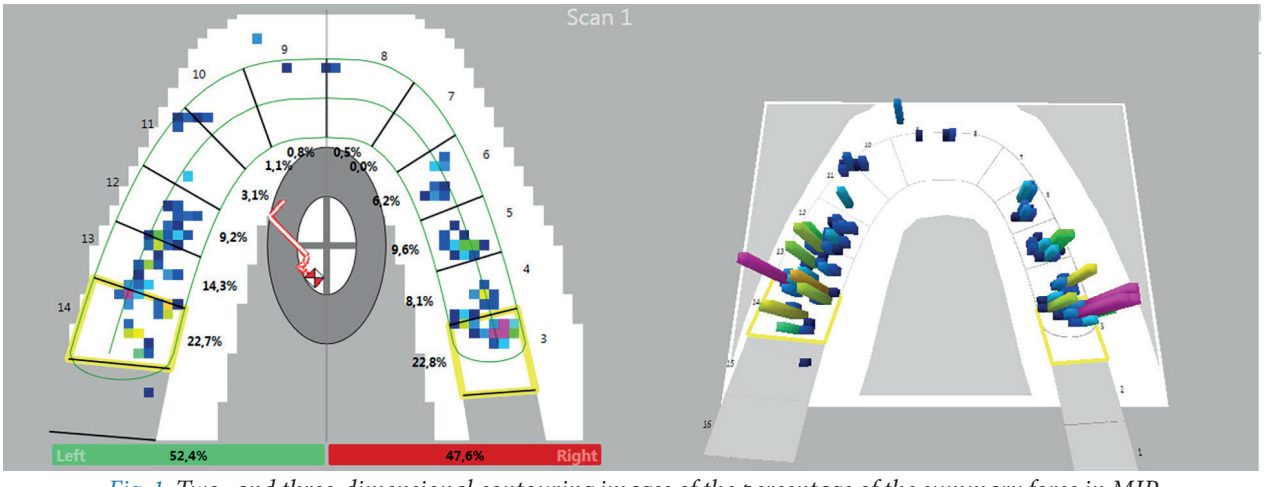

Fig. 1. Two- and three-dimensional contouring images of the percentage of the summary force in MIP with predominance of the percentage of the summary force on the distal teeth

teeth. The presented figures showed balanced distribution of the forces in the central occlusion, with higher value of the masticatory force in distal direction – Filtchev phenomenon (15). This is demonstrated also by fields with super-strong contacts, which the software registered and showed as yellow areas (Fig. 1).

The occlusal harmony in central occlusion is graphically presented (Fig. 2 and Fig. 3). It gave the impression that in the time interval B-C (time of

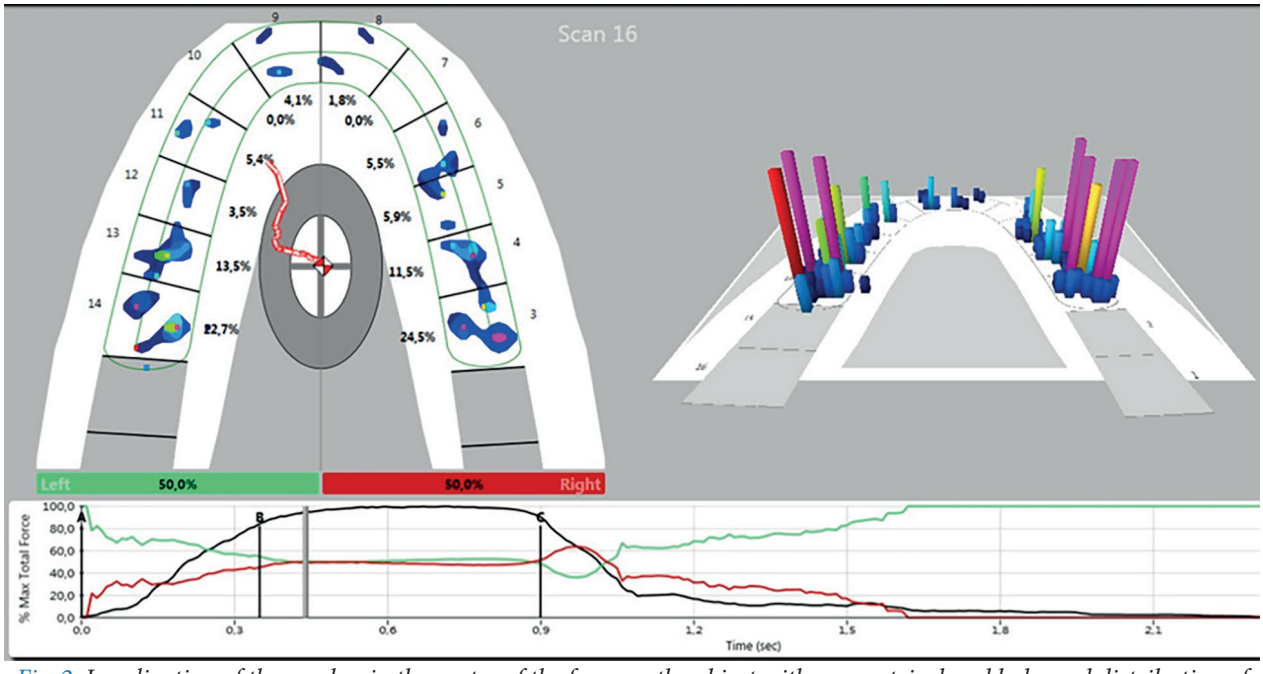

Fig. 2. Localization of the marker in the center of the force on the object with symmetrical and balanced distribution of the summary force in MIP)

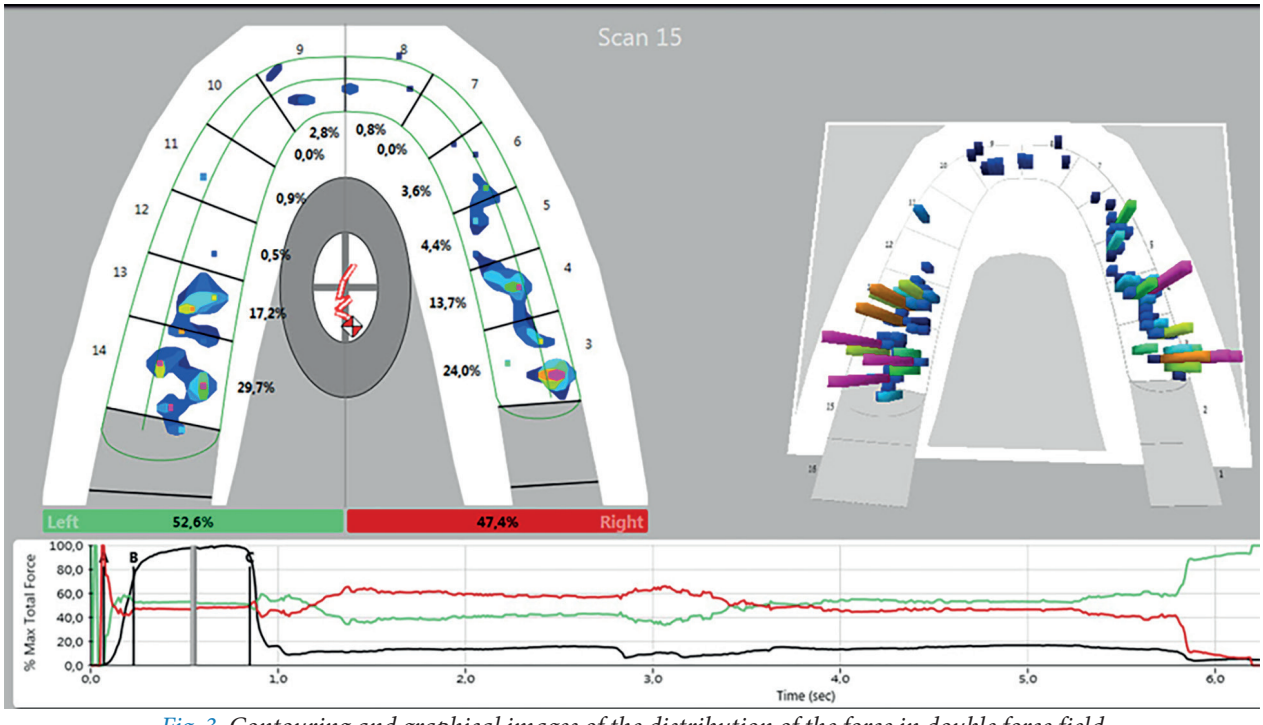

Fig. 3. Contouring and graphical images of the distribution of the force in double force field

MIP) the green and the red force curves had parallel direction and overlap, which means equivalent force distribution in both halves of the frames in MIP, 50.0% (Fig. 2) and 50.6% to 47.4% - left to right (Fig. 3), respectively.

Another important element, which represents the force balance, was the placement of the marker in the center of the force. In the examined group it is positioned on the object of the force in the MIP frame.

Fig. 3 shows optimal occlusal relationships where the marker of the center of the force is on the object, and its trajectory is parallel to the palatal medial line from the place of the first contact between the teeth until reaching multiple contacts in MIP.

DISCUSSION

Our results confirmed the ones from other authors (17,19,21) according to which a month after the application of the crowns by the conventional method the occlusal relationships were completely compensated.

The high caries distribution among children (22-27), as well as all diseases of hard tooth tissues in all age groups, necessitates the need of searching for other alternative methods of restoration and treatment of children's teeth in the field of pediatric dentistry (28-30).

The use and the high-quality application of PMCs provides the integrity and the health of the tooth until its physiological exfoliation, without any replacement of the restoration. PMCs are valuable tool in the clinical treatment options for the dentist, especially for restoration of severely destroyed primary molars (31,32,33).

A new approach for treatment of primary molars with PMCs was implemented by Evans et al. (34). The crowns are cemented without previous caries excavation or tooth preparation, without any local anesthesia. Similar clinical trials are going on to compare the longevity and the efficiency of PMCs applied using the Hall technique and conventional restorations, which are preferred by most of the dentists as a restoration material for primary molars (35). Before the Hall technique, the opportunities for restoration materials of primary teeth in the pediatric dentistry were quite limited (36).

The method may be a good alternative for children who are incapable of enduring the conventional methods of treatment with local anesthesia. However, this technique cannot be used in all clinical cases and is contraindicated for teeth with pulp inflammation (37-40).

For now, the data from the scientific studies regarding PMCs as a tool for restoration of severely destroyed primary molars are quite insufficient. However, it was proved that they were the option with the highest success rate regarding the mechanical durability with an average longevity of 40 months. For the primary molars they provide excellent tightness for non-operative caries sealing by the Hall technique and after pulpal treatment with vital and mortal methods. PMCs have a protective effect concerning secondary caries and teeth-jaw malformations as they can serve as abutments for space maintainers, when it is necessary. All comparisons made between the filling materials and PMCs used for treatment of caries affecting several surfaces reported the advantage of PMCs (41,42,43).

CONCLUSION

The received data confirmed that the restoration of decayed teeth with PMCs maintained the occlusal harmony in the dentition.

REFERENCES

1. Kerstein RB. Disclusion time measurement studies: Stability of disclusion time: A 1-year follow-up study. J Prosthet Dent. 1994; 72(2):164-8. doi: 10.1016/0022-3913(94)90075-2.
2. Kerstein R. T-Scan II's computerized occlusal analysis brings your practice into the future. Cont Esth. 1999; 1(1):90-4.
3. Kerstein R. Understanding and using the center of force. Dent Today. 1998;17(4):116-9.
4. Kerstein RB, Chapman R, Klein M. A comparison of ICAGD (Immediate Complete Anterior Guidance Development) to "mock ICAGD" for symptom reductions in chronic myofascial pain dysfunction patients. Cranio. 1997;15(1):21-37. doi: 10.1080/08869634.1997.11745990.
5. Kerstein RB, Wright N. Electromyographic and computer analyses of patients suffering from chronic myofascial pain-dysfunction syndrome: before and after treatment with immediate complete anterior guidance development.

J Prosthet Dent. 1991; 66(5):677-86. doi: 10.1016/0022-3913(91)90453-4.

6. Maness W. Computerized occlusal analysis. J Can Dent Assoc. 1993;59(8):701-2.

7. Maness WL. Force Movie. A time and force view of occlusion. Compendium Contin Educ Dent. 1992; 10:404-8.

8. Cartagena AG, Sequeros OG, Garrido-Garcia VC. Analysis of two methods for occlusal contact registration with the T Scan system. J Oral Rehabil. 1997; 24(6):426-32. doi: 10.1046/j.1365-2842.1997.00507.x.

9. Garrido-Garcia VC, Cartagena AG, Sequeros OG. Evaluation of occlusal contacts in maximum intercuspation using the T Scan system. J Oral Rehabil. 1997; 24(12):899-903. doi: 10.1046/j.1365-2842.1997.00586.x.

10. Sequeros OG, Garrido-Garcia VC, Cartagena AG. Study of occlusal contact variability within individuals in a position of maximum intercuspation using the T Scan system. J. Oral Rehabil. 1997; 24(4):287-90. doi: 10.1046/j.1365-2842.1997.00506.x.

11. Dimova-Gabrovska M. Okluzalni riskovi faktori za KMD kompyutriziran okluzalen analiz, „Obshtestveno dentalno zdrave" – postizhenia, predizvikatelstva, perspektivi. Sofia; 2016. pp. 114-9. (in Bulgarian).

12. Dimova-Gabrovska M. Disclusion in excursive mandibular movements by CMD patients - computerized analysis at laterotrusion. Praemedicus. 2016; 33(1):33-7.

13. Krysteva K. Izrabotvane na inley poddarzhana bezmetalna konsruktsia. Buldent News. 2000; 1:6-7. (in Bulgarian).

14. Krysteva K. Opredelyane i analiz na okluzalnite kontakti. Buldent News. 1999; 4:4-6. (in Bulgarian).

15. Kalychev YA. Okluzalno nalyagane i naprezhenia v parodonta - analiz i nasoki za klinichno prilozhenie, disertatsia za poluchavane na obrazovatelnata i nauchna stepen „Doktor". Plovdiv; 2003. pp. 41-8. (in Bulgarian).

16. Filchev A, Kalychev YA. Fenomen na dominirane na nay-silnite kontakti v tsentralna okluzia, dentalna meditsina. Sofia; 2008. pp. 118-24. (in Bulgarian).

17. Chakalov I, Djorova I, Ivanova P, et al. Sredstva za registrirane na statichni i dinamichni okluzalni saotnoshenia (literaturen obzor). Ortodontski pregled. 2014; 16(1): 16-22. (in Bulgarian).

18. Djorova I, Andreeva L. Metodika za izsledvane na okluzalnite saotnoshenia sas sistemata T-SKAN. Kn. Treti nauchen kongres 23-24 noemvri 2013; Sofia. 47-52. (in Bulgarian).

19. Djorova I. Izsledvane na okluzalnite saotnoshenia vav finishirashtata faza na ortodontskoto lechenie. Avtoreferat. Sofia; 2016. p. 39. (in Bulgarian).

20. Dimova-Gabrovska M. Savremenni tendentsii i gnatologichni predpostavki v diagnostikata i rehabilitatsiyata na kraniomandibularnite disfunktsii, Disertatsia za doktor na naukite. Sofia; 2015. pp. 162-6. (in Bulgarian).

21. Gallagher S, O'Connell BC, O'Connell AC. Assessment of occlusion after placement of stainless steel crowns in children - a pilot study. J Oral Rehabil. 2014;41(10):730-6. doi: 10.1111/joor.12196.

22. Georgieva M, Andreeva R. Caries distribution by teeth groups among 12-18-year-old children in Varna. Varna Med Forum. 2018;7(1): 131-5.

23. Nikolova T, Andreeva R. Prevalence of dental decay among children suffering from congenital heart diseases. Scr Sci Med Dent. 2018;4(2):22-5. doi: 10.14748/ssmd.v4i2.5479.

24. Nikolova T, Andreeva R, Georgieva M, Shivachev P. Prevalence of dental decay and periodontal diseases among children suffering from congenital heart diseases. A literature review – part III. Scr Sci Med Dent. 2018;4(1):7-11. doi:10.14748/ssmd.v1i1.4310.

25. Nikolova T, Andreeva R, Georgieva M, Shivachev P. Prevalence of dental decay and periodontal diseases among children suffering from congenital heart diseases. A literature review–part II. Scr Sci Med Dent. 2017;3(2):48-55. doi:10.14748/ssmd.v3i2.4312.

26. Nikolova T, Andreeva R, Georgieva M, Shivachev P. Prevalence of dental decay and periodontal diseases among children suffering from congenital heart diseases. A literature review–part I. Scr Sci Med Dent. 2017;3(2):36-40. doi:10.14748/ssmd.v3i2.5009.

27. Andreeva R. Dental status assessment of children treated under general anesthesia. Scr Sci Med Dent. 2018;4(1):20-4. doi:10.14748/ssmd.v1i1.5199.

28. Georgieva-Dimitrova M. Laboratory examination of cement thickness for zirconia and composite

inlays cemented with two types of fixing agents. Scr Sci Med Dent. 2019;5(1):47-51. doi:10.14748/ssmd.v5i1.5905

29. Georgieva-Dimitrova M. Roughness comparison of samples of indirect composite and zirconium ceramics. Varna Med Forum.2019;8(2):20-4.

30. Dimitrova D, Andreeva R, Dimova-Gabrovska M. Application of aesthetic crowns in children patients. Varna Med Forum. 2018;7(1): 141-5.

31. Casamassimo CJ. The venerable stainless steel crown. Pediatr Dent. 1994;16(2):83.

32. Curzon MEJ, Pollard MA. Do we still care about children's teeth? Br Dent J. 1997;182(7):242-4. doi: 10.1038/sj.bdj.4809356.

33. Hartman CR. The open-faced stainless steel crown: an aesthetic technique. ASDC J Dent Child. 1983;5(1):31-3.

34. Evans DJP, Southwick CAP, Foley JI, Innes NP, Pavitt SH, Hall N. The Hall technique: a pilot trial of a novel use of preformed metal crowns for managing carious primary teeth. Scottish Dental Practice Based Research Network. Available at: http://www.dundee.ac.uk/tuith/Articles/rt03.htm. Accessed: February 1, 2011.

35. Randall RC. Preformed metal crowns for primary and permanent molar teeth: review of the literature. Pediatr Dent. 2002;24(5):489-500.

36. Goldberg NL. The stainless steel crown in pediatric dentistry. Dent Digest. 1969;75(9):351-5.

37. Georgieva-Dimitrova M. Case report: the Hall technique as a method of choice in case of asymptomatic closed pulpitis in primary teeth. Scr Sci Med Dent. 2019;5(1):52-8. doi:10.14748/ssmd.v5i1.5909.

38. Innes NP, Stirrups DR, Evans DJ, Hall N, Leggate M. A novel technique using preformed metal crowns for managing carious primary molars in general practice: a retrospective analysis. Br Dent J. 2006; 200:451-4; discussion 444. doi: 10.1038/sj.bdj.4813466.

39. Roberts JF, Attari N, Sherriff M. The survival of resin modified glass ionomer and stainless steel crown restorations in primary molars, placed in a specialist paediatric dental practice. Br Dent J. 2005;198(7):427-31. doi: 10.1038/sj.bdj.4812197.

40. Schriks MCM, Van Amerongen WE. Atraumatic perspectives of ART: psychological and physiological aspects of treatment with and without rotary instruments. Community Dent Oral Epidemiol. 2003;31(1):15-20. doi: 10.1034/j.1600-0528.2003.00021.x.

41. Al-Eheideb AA, Herman NG. Outcomes of dental procedures performed on children under general anesthesia. J Clin Pediatr Dent. 2003;27(2):181-3. doi: 10.17796/jcpd.27.2.k3307186n7086r11.

42. Braff MH. A comparison between stainless steel crowns and multisurface amalgams in primary molars. J Dent Child. 1975;42(6):474-8.

43. Einwag J, Dunninger P. Stainless steel crown versus multisurface amalgam restorations: an 8-year longitudinal clinical study. Quintessence Int. 1996;27(5):321-3.