COMPUTER ASSISTANCE HARNESSED IN MODERN DENTISTRY TREATMENTS

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Abstract: *Dysfunctional occlusal contacts can lead to disorders in all parts of the dento-maxillary system, disorders which may be accompanied by a more or less painful symptomatology for the patient. The intensity of the symptomatic panel is also determined by the force and activity duration of the dysfunctional occlusal contact. These parameters (duration and force) cannot be evaluated by traditional examination methods of the occlusion. In this article, the authors aim at illustrating, by means of a clinical case, how these dysfunctional occlusal contacts can be identified and removed by the use of the selective grinding technique assisted by the T-Scan III computer system.*

Rezumat: *Contactele ocluzale nefuncţionale pot duce la tulburări la nivelul tuturor componentelor aparatului dento-maxilar, tulburări care pot fi însoţite de o simptomatologie mai mult sau mai puţin dureroasă pentru pacient. Intensitatea tabloului simptomatologic este determinată şi de forţa şi timpul de acţiune al contactelor ocluzale nefuncţionale. Aceşti parametrii (timp şi forţă) nu pot fi evaluaţi prin mijloacele clasice de examinare a ocluziei. În cadrul acestui articol, autorii îşi propun să ilustreze, prin intermediul unui caz clinic, modul în care aceste contacte ocluzale nefuncţionale pot fi identificate şi îndepărtate prin tehnica şlefuirilor selective asistate de sistemul informatic T-Scan III.*

INTRODUCTION

The nonfunctional occlusal contacts represent one of the main causes not only behind the T.M.J. dysfunction, of the imbalances in the mandible muscles responsible for mobility and of the periodontal pathology but it is also responsible for various affections at the level the components of the stomatognathic system. These non-operating contacts may be present at the level of the natural teeth, as well as at the level of the artificial teeth, created in different types of prosthetic restoration works (be they fixed, mobile, implanted etc.). The harmful effects of the nonfunctional occlusal contacts can be found at the level of T.M.J. or that of the muscle in a more or less painful symptomatology.

There are already numerous articles (clinical reports especially) which show the positive influence selective occlusal polishing has on the improvement or disappearance of symptoms caused by occlusal dysfunction.

The classical therapeutic analysis diagram for occlusal balancing is extremely complex, toilsome and is generally reserved for doctors possessing a large amount of experience in the field.

The use of the T-ScanIII computerized system for occlusal analysis and equilibration embodies a highly accurate solution, having promising results and can easily be implemented in any dental office. The removal of the clinical-technical linking from the classical method and the utilization of the T-Scan III software for the identification and removal of the nonfunctional occlusal contacts, at a level of precision, which is impossible to reach by conventional clinical examination, may prove to be the expected solution of a large number of physicians.

In this article, the authors aim at illustrating the use of the computerized T-Scan III system to eliminate specific symptomatology of the nonfunctional occlusion by help of a clinical case.

Occlusal dysfunction and its computer aided therapy

Occlusal dysfunction may be present in:

- dental patients – due to dental malpositions
- partially edentulous patients wearing no prosthesis – due to the displacement of the neighboring teeth, due to edentulous gaps (egressions, extrusions, changes, rotations etc.) and also due to loss of some dental contacts by absence of one or more teeth.
- partially edentulous patients wearing prosthesis – as failure to comply with one or more of the 5 principles of the fundamental occlusion, as set by Dawson.(1)
- total edentulous patients wearing mobile or fixed prostheses (fixed prosthetic implant superstructure) - for the same reasons mentioned in the previous paragraph.(2)

Clinical signs of occlusal parafunctions are felt on the third level:(3)

- teeth (wear facets on the crown or dental prosthetic restorations, periodontal mobility, tenderness, fractures or cracks etc.)
- muscle (muscle fatigue and / or pain; masseter hypertrophy etc.)

- T.M.J. – (articulator sound, internal derangements, radiological changes)

According to Klineberg (4) the intensity of clinical signs of occlusal dysfunction is influenced by many factors, among which: the duration of occlusal contacts during various movements of the mandible, the occlusal force during the mandibular function and parafunction, the teeth clenching force (at rest) or the full force of clenching the teeth during mandibular movement.

The classical method ("analogical") of occlusion analysis includes the following steps:(2)

1. The clinical and radiological examination.
2. The dental imprint of both arches to achieve study models.
3. The identification of the jaw's reference position to the base skull by means of the facebow.
4. The identification of the centric relation position.
5. The identification of the extreme positions in propulsion and left/right laterality.
6. The transfer of the previous measurements, fitting the models in the articulator, setting the articulator.
7. The analysis of the static and dynamic occlusion on the articulator and identification of any premature contacts and working and non-working interferences.
8. The execution of selective polishing on the study model to eliminate nonfunctional contacts (selective polishing "in vitro")
9. The transfer of these polishing to the patient's teeth (selective polishing "in vivo").

This entire clinical-technical chain can be subject to a fairly large scale of errors (due to the many steps that must be completed): it is time consuming and requires solid knowledge and a minimum experience of both the doctor and the technician. The alternative method is the "computerized" T-ScanIII IT system (Tekscan Inc., South Boston, MA USA). This system was designed specifically for highly accurate and precise determination of duration and forces of occlusal contacts exterted by a patient during the various functions. The system uses a highly sensitive but thin (100 microns) sensor, which does not interfere with the patient's occlusion and allows recording at a frequency up to 495Hz of how the occlusal contacts evolve and develop.(5) The software's interface displays in four windows all information related to: the amount of occlusal forces exerted on each dento-dental contact, the precise location of these contact on the surfaces of the teeth, the duration of occlusion, the duration of the unoccluded state, graphs for duration v force, etc. All this information is extremely intuitive and easy to understand both for the doctor and by the patient.

In the following, we will present the use of the TScanIII in the occlusal analysis and balancing by the example of a specific patient symptomatic of dysfunctional occlusion.

CASE REPORT

Patient G.I., at the age of 42 years

Reason for the appearance: discomfort in the right TMJ associated with a burning sensation in the suborbicular area and lachrymal hypersecretion in the right eye. Interdisciplinary consultation with an ophthalmologist led to a presumptive diagnosis of "of an optic nerve irritation syndrome" with the possible cause being a center of inflammation at the level of the teeth.

Clinical and radiological examination revealed the existence of pulp vitality in all teeth on the hemi-arcades 1 and 4, excluding a possible center of inflammation of dental infection. Clinical and radiological examination at T.M.J. showed no pathological changes.

Muscle examination revealed hypertonicty of the muscles on the right side. Not only the lack of centers of inflammation but also the presence of abrasion facets (a sign specific to parafunctions) led us to the conclusion that the only possible dental cause would be bound to an occlusal imbalance. It has thus been decided that the occlusion be examined using the TScan III system.
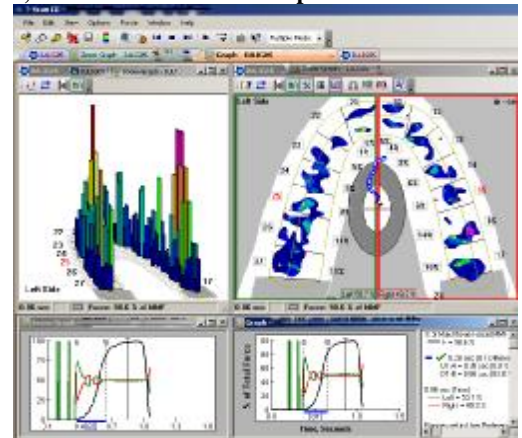
Figure no. 1. Presence of facets of abrasion on the lower right premolars

Stages of treatment:
1. **The occlusal examination during closing movement, under maximum intercuspation:**

Figure no. 2. The results of the recording during closing movement, under maximum intercuspation


There is an almost perfect balance:
- The force distribution between the two hemi-arches is 50,7%:49,3%.
- The resultant of the occlusal forces is placed in the centre (a fact which confirms the balance of occlusal force distribution at the level of the mandibular arch).
- The occlusal timeframe is adequate: 0,29sec.
- There are no premature contacts.
- Conclusion: there is no need for corrective surgery.

2. **Occlusal examination during propulsion movement**

Figure no. 3. Results of the recording the propulsion movement
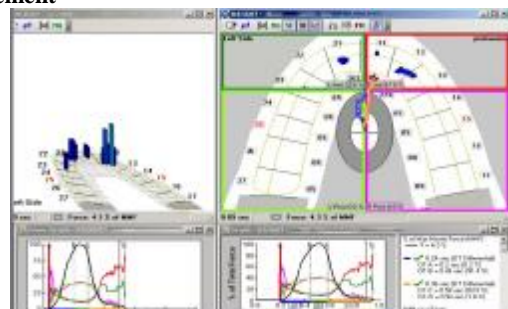
During the analysis of this type of movement, there is again a balance in the analyzed parameters:

- Occlusion and disclusion time is within normal limits.
- There is no major interference at the level of the lateral teeth. One can note but a slight delay in the disclusion of the lateral teeth on the right side, without exceeding the limits of normal disclusion time (DT) of 0,5 seconds.
- The end of the propulsion movement is supported by 3 incisors (1.2, 1.1, 2.1).
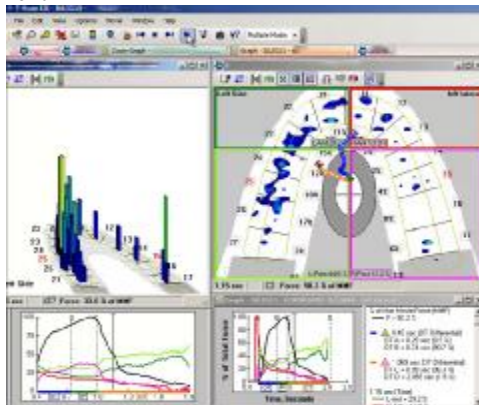
3. Examination of the left lateral movement.

When analyzing this movement, we can observe the following changes:

- Disclusion time is much increased: 1,089 sec instead of 0,5 sec (maximum)

There is interference on the working side (at the level of the teeth 2.6, 2.5, 2.4) as well as on the non-working side (at the level of the teeth 1.7, 1.5, 1.4).

Figure no. 4. Results of the recording of the LEFT lateral movement

It has been decided to carry out selective polishing on these teeth (first on the on-working and then on the working side). After the selective polishing the lateral movement was recorded once again and the new recording showed:

- disclusion time back in normal parameters.
- the disappearance of working and non-working interferences.
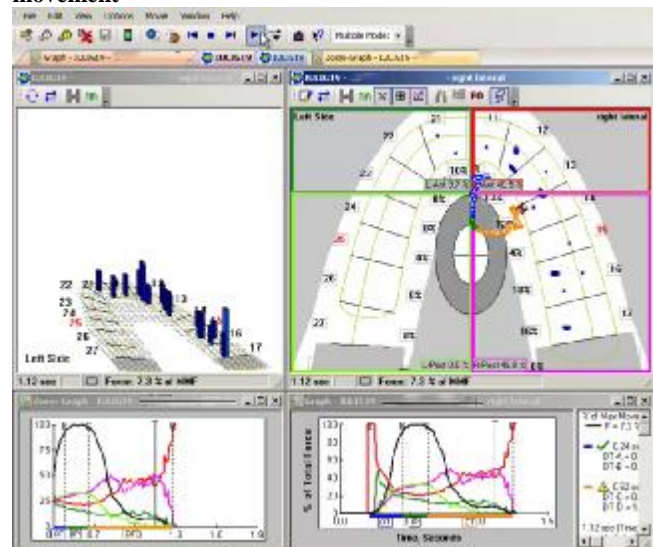- return to the canine guidance.

Figure no. 5. Results of the recording of the LEFT lateral movement, after the carrying out of selective polishing
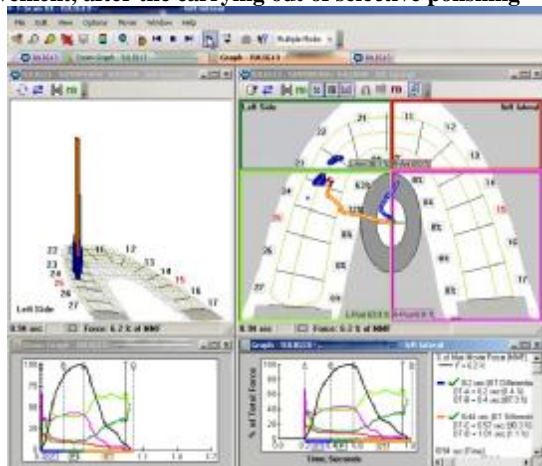
4. Examination of the right lateral movement

- When analyzing this movement, we can observe the following:
- Disclusion time is only slightly increased (0,62 seconds versus the maximum allowed 0,5 seconds).
- There is no interference on the non-working side.
- There is interference on the working side, at the level of the lateral group and the frontal teeth, which block the access to a pure canine guidance.

Figure no. 6. Results of the recording of the RIGHT lateral movement

After carrying out selective polishing at the level of the detected interferences the right lateral movement as recorded once again and the new recording showed:

- Disoclusion time returned to its normal parameters: 0,459 sec.
- The interferences on the working side disappeared.
- The pure canine guidance was regained.

Figure no. 7. Results of the recording of the RIGHT lateral movement, after the carrying out of selective polishing

CLINICAL ASPECTS
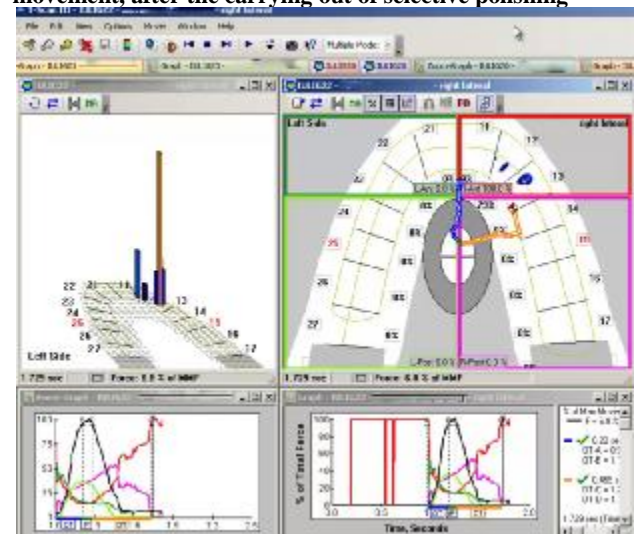
The control at a week after the execution of the grinding showed the maintenance of the obtained parameters at the first meeting and the complete disappearance of the painful symptoms, which existed at the time of the first presentation. Allow us to quote the patient's extremely plastic and suggestive answer at our request to describe the situation after the occlusal balancing "It feels like when you take your snowshoes off and put house shoes on".

DISCUSSIONS

The painful dysfunctional cranial-mandibular syndrome, which is generated by occlusal disorder, reveals a very complex pathology, involving both a much richer symptomatology and also therapeutic measures which are much more elaborate than simple selective occlusal grinding for rebalancing.

We do not want to minimize or simplify the occlusal therapy approach involving many more sequences than those described in this article.

We want to bring to the attention of the readers an IT tool (TScan III), which provides any doctor with the possibility to eliminate many question marks about the manner in which unfunctional occlusal contacts can be identified and removed. In many clinical cases, these selective grinding of dysfunctional contacts may lead to the disappearance or reduction of the symptomatology.

The information provided by the system related to the forces and the duration of the occlusal contacts are impossible to obtain by any other means of analysis and opens almost unlimited possibilities in terms of applicability in dentistry.

There are quite few studies that highlight the advantages of one or the other of the occlusal therapy methods for removing the effects of bruxism, especially due to the difficulty of creating research protocols in which the examined parameters can be quantified. T-Scan III comes to the aid of the research in this area by the facilities it offers:

The individual file for each patient customizes the status of both the teeth and the tooth size in the dental arch. Practically, the virtual dental arch corresponds from the dimensional perspective with the real arch, which makes it easy to identify in reality areas that need intervention.

- The storage of all information collected at each determination.
- The possibility of comparative graphs between multiple records regardless of the time of their realization.
- The possibility of transforming each entry into a video file that exemplifies much easier than a static image, the dynamics of the occlusal contacts.
- The possibility to export the collected information in different formats.
- The possibility to integrate the information into the basic software of the clinic and into the patient's general file.
- The possibility of connecting to the system Bioresearch's EMG through the application BioEMG-Tscan Integration Module. Thus, information about head and neck muscle activity can be recorded simultaneously to data related to the occlusal contacts.

CONCLUSIONS

- The use of the T-Scan III system allows a better quality in the dental treatments providing information at a level of accuracy unattainable by conventional methods.

- From the economic point of view it is a "winning" solution allowing the elimination of several clinical-technical stages (including the arising costs).
- The duration of the treatment is usually reduced to 1-2 sessions, followed only by reassessments within the limits of the regular control sessions.
- The software is extremely easy, simple to use and understandable for someone with minimal knowledge of computer usage. Of course, the correct use of the information provided by the system requires a good training and an accurate understanding of the phenomena characteristic of functional and dysfunctional occlusion.
- The TScan III system paves the way for a study and research program, which is genuinely valuable in the occlusal analysis and balancing.

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