Treatment of Sleep Apnea with Herbst Mandibular Advancement Splints

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Abstract

Sleep apnea and obstructive sleep disorders represent a danger for the cardiovascular system and metabolism. They also give rise to somnolence, which can cause accidents at work or road accidents. Along with positive pressure ventilation, oral mandibular advancement devices are today regarded as reliable forms of treatment. Unfortunately, not all patients adhere fully to the treatment, particularly over time. Some even abandon it entirely. The reasons generally put forward to explain this poor compliance are discomfort, pain, occlusal problems and poor psychological disposition (Figure 1). Orthesis over three years showing the high levels during the first months of treatment.

Keywords: Obstructive sleep apnea; Mandibular advancement device; Compliance; Manufacture

Analysis of Publications 2004-2011

Twenty-three referenced articles concerning the efficacy of the Herbst appliance for the treatment of obstructive sleep apnea have been studied. Table 1 lists a selection of articles on the Herbst appliance, presented methodologically [1-25]. Also listed are three doctoral theses presented in two French medical schools (Table 2) [26-28]. Table 3 lists 23 articles presented in terms of efficacy of treatment of respiratory disorders. A summary report on the subject of sleep presented to the French Ministry for Health and Solidarity in December 2006 (Appendix Ch. 2.2.3.), concluded in these terms: “Currently only made-to-measure orthosis have proved their efficacy in controlled trials. Herbst mandibular advancement splints, used in orthodontics since 1980, remain the most widely-studied systems.”

This review of the literature is illustrated by the captions accompanying figures derived from these articles (Figures 2-12); adverse and parasitic effects: the discomfort caused by the Herbst advancement splints is no different from that described with other types of oral orthosis or with ventilators. But, unlike other models [29], they remain well positioned on the teeth.

While TMJ pain is only temporary, tooth pain persists if it is linked to the initial state of the mouth or to movements caused by the orthosis. Pain in the facial muscles is more often the result of poor adjustment of the amplitude of propulsion. As for breakages, they are due to faulty manufacturing methods (Table 4).

Prescriptions and Contra-Indications

The economic filter

Patient selection represents a radical approach to the reduction of failures of compliance. The difficulty is to find an infallible method to avoid excluding patients with a favourable profile. In France, the conditions for reimbursement of costs are laid down by law: patients can only benefit if the treatment by orthosis:

- is second-line treatment (after refusal of CPAP);
- is first-line treatment for an index of between 15 and 30,
- without excessive somnolence or severe cardiovascular comorbidity;
- and is prescribed by a sleep specialist. However, no provision is made for the reimbursement of dental and stomatological procedures and consultations!

The Initial Dental State

Today, too many ortheses are still prescribed despite the presence of periodontal disease, dislocation, desmodontitis, ankylosis of the temporal-maxillary joints, multiple missing teeth, broken or curious teeth, etc. According to Petit et al. [30], 50% of patients requiring an orthosis have periodontal abnormalities, 31% have more than 10 missing teeth and 20% have bridges that complicate the insertion of an orthosis. More than 50% of patients present with malocclusions that expose some of them to a risk of irreversible occlusal modification caused by the side effects of the orthosis: subjects in Class I, Class III and with overbite are more at risk than those in Class II without overbite.

Since more than 50% of the population suffers from occlusal asymmetry, and since some cases of hyperdivergence can easily be worsened, the widespread use of advancement devices is not without certain consequences. After being worn for some time, mandibular

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advancement orthoses modify occlusion, according to Almeida et al. Doff et al. [32], the most visible man-infection of these changes is the advancement of the lower teeth. While these movements may be beneficial for some subjects who are initially in Class II, for the others (44.3%) they cause permanent discomfort. Over a period of 5 years this is alleged to be the main cause of abandonment of treatment by mandibular advancement splints. Pancherz and Hansen [33] sought to reduce these parasitic movements by changing the support, but without success. Wescaler and Pancherz [34] noted that whether they were cast or banded, splints always induced this movement (11.8” W 3.7” for the 107 latter).

Prevention of Discomfort and Device Fraility
Complaints
Surveys of apnea sufferers treated with splints highlight the following complaints:
- Transient complaints: TMJ pain, pain in masticatory muscles, poor stability of the device, discomfort caused by lower pivots, hypersialosis;
- Long-term complaints: dry mouth, tooth pain, occlusal problems, mobility of teeth.

Standing grievances:
- Dry mouth
- Toothache
- Occlusal genes
- Tooth mobility

The information obligation: Considered as “knowing”, the practitioner is legally obliged to inform the patient of the disadvantages and ways to address them. The marketing of any laboratory does not absolve the practitioner’s professional responsibility [41-43].
Table 3: Data similar to those of Table 2 presented according to respiratory efficacy.
Technical support

Patient comfort must be sought carefully at the first appointment. To eliminate the pains of ATM and musculature, nothing is more effective than activating the propulsion gradually. Thus, the masticatory muscles and the back-meniscal ligaments have time to become accustomed without painful reaction [44]. Postherpetic expressed in many articles (Bloch, Evenoff, Clark) could be prevented by reducing the magnitude of the propulsion from the start of treatment. Also in those first moments, the practitioner should be concerned about the retention of the orthosis: too maintained, it will require grinding; too loose, it will require a reline. A special care should be given to the adaptation of the lower lip opposite the pivots. With some forms of arches and adjacent tissues, it will not hesitate to change the location of these pins:

The manufacturing process: Breakage, lack of retention or unexpected discomfort always originally a development error. The meta-analysis of 36 Ahrens 2010 (of 1475 references) joined our opinion, “The success and subjective input depend on a variety of factors including the type of material, technical or manufacturing model devices individualized to determine the propulsion.”
Also remember a manufacturing protocol bringing more unreliability:

- To secure the inclusion of son and pivots, the molding technique can be used using two plates: a first formed on the model is 0.5 mm thick and a second 1.5 mm thick.

<table>
<thead>
<tr>
<th>SL No.</th>
<th>Author</th>
<th>Conclusions</th>
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<tbody>
<tr>
<td>1</td>
<td>Eveloff</td>
<td>Discomfort at the ATM level and dental pain.</td>
</tr>
<tr>
<td>4</td>
<td>Bloch</td>
<td>Pain and discomfort of ATM, masticatory muscles and teeth</td>
</tr>
<tr>
<td>5</td>
<td>Shadaba</td>
<td>32% experienced occlusion disruption, 36% drought, 38% had ATM pain initially, 23% experienced discomfort in the ATM, 35% facial discomfort, 35% Dental pain</td>
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<tr>
<td>6</td>
<td>David</td>
<td>Strong correlation between the change of the supraocclusion index and ANB.</td>
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<tr>
<td>7</td>
<td>Clark</td>
<td>37% dental pain, 26% disturbance due to change in occlusion, 41% dryness, 30% feel discomfort at the ATM after, 23% ATM pain.</td>
</tr>
<tr>
<td>8</td>
<td>McGown</td>
<td>49 users out of 166 complained of side effects, 67 that they snored less (p: 0.001), 97% were effective even after shutting down the device. The reasons why patients no longer bore the orthosis were: pain (52%), perceived efficacy (10%), social circumstances, dental treatment. 13% disruption of occlusion, 10% hypersialoarea, 38% feel discomfort at the level of discomfort 36%, gene during sleep 16%, bad port related to discomfort 23%.</td>
</tr>
<tr>
<td>9</td>
<td>Fritsch</td>
<td>Mucosal dermatitis (86% of patients), dental discomfort 22%, dental pain (59%), hypersalrectal pain (22%), ATM pain 22%, muscle pain 22% Dental displacements: upper incisors / occlusal plane: -1° ± 2° after 12 to 30 Months (0.05 of p). Incisive overlap and overhang: -1 mm identical minor effects for both types of appliances</td>
</tr>
<tr>
<td>10</td>
<td>Pétable</td>
<td>Interest in regulating the mandibular advancement during the patient’s fall asleep for an optimization of the polysomnographic responses.</td>
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<td>14</td>
<td>Lawton</td>
<td>No significant difference between the two devices regarding quality of life or side effects. 5 preferred the Twin-block, 9 preferred the Herbst.</td>
</tr>
<tr>
<td>15</td>
<td>Battagel</td>
<td>Vertical and horizontal change of the incisors of 0.4 mm, correlated with an increase of the overlap, the two effects being independent of the amplitude of the propulsion.</td>
</tr>
<tr>
<td>17</td>
<td>Johal</td>
<td>A difference in energy vitality (p: O, O1) was observed following the 4 months following treatment. Orthotics have a significant effect on a limited number of quality of life domains.</td>
</tr>
<tr>
<td>20</td>
<td>Martinez</td>
<td>Subjective, permanent, transient, permanent effects over 5 years: No effect on TMJ but permanent occlusal changes.</td>
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<tr>
<td>21</td>
<td>Barros</td>
<td>Good adhesion due to fusion with orthodontic treatments.</td>
</tr>
<tr>
<td>22</td>
<td>Johal</td>
<td>Significant improvement in several emotional, physical, quality of life, vital energy perception indicators.</td>
</tr>
<tr>
<td>23</td>
<td>Vezina</td>
<td>No difference was found between MAA for subjective and objective side effects, except in an uncertain manner, greater early masticatory muscle pain (p=0.02) and residual tongue pain (p=0.04) in the compression group.</td>
</tr>
</tbody>
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Table 4: Presentation according to complaints expressed by patients.

The Church of study 38 concludes by noting that one-day training for a general is sufficient to control it. (Success rate 48%). Any pain, any discomfort may result in discontinuation of treatment, especially in the absence of motivation by a practitioner. A decreased range of propulsion as the grinding sound associated with a few words of comfort can go a tour status to failure.

**Conclusion**

If Herbst updated on gutter device is a generic method for reliable and proven mandibular propulsion. Also, the main failure of treatment with orthoses Herbst is not medical but behavioural, by
patient membership loss. It is on this crucial point that the expertise and knowledge provide the practitioner, came to the fore. Without controls, parasites tooth movement can occur and develop. How to eliminate injuries, pain and discomfort without careful control? How to avoid the abandonment, without encouragement and information from the practitioner? How to conduct suitable treatment with a faulty initial dental condition? How not to expose themselves to major failures without following a reliable and rigorous manufacturing process?

References


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44. Health authority, Medical devices and associated services for the treatment of respiratory insufficiency and sleep apnea. Framing Note March 30, 2011.