Comparison of Dental Side Effects between Two Oral Appliances for Sleep Apnea - a pilot study

Hans Nemeczek; tutor Marie Marklund
ABSTRACT

Oral appliances (OAs) represent a widespread treatment modality for patients with mild to moderate obstructive sleep apnea (OSA). OAs exist in many designs, but it is unknown if there are differences in terms of side effects between the various types. The aim of this pilot study was therefore to evaluate two OA designs, one rigid type of appliance (OA_R) and a more flexible one (OA_F) regarding increased crowding of the lower front teeth. Six patients with a mean age of 58 years (3 men) who had used OA_R and another six patients with a mean age of 63 years (4 men) who had used OA_F for at least 2 years were included in the study. The patients responded to a questionnaire and had impressions for plaster casts for analysis of the irregularity in the front teeth using Little's index. The distances between the contacts points between two adjacent teeth were measured in the frontal areas. The OA_F group had an increased irregularity of lower front teeth with 0.89 mm (p>0.05) and the OA_R group had a reduced irregularity of 0.58 mm (p>0.05). The difference between the groups was significant (p=0.041). There were no changes in crowding of the upper incisors in either group. Patient satisfaction with treatment did not differ between the groups. The present results indicate that a flexible type of OA increase the irregularity of the lower front teeth compared with a more rigid OA. The results should be confirmed in a larger sample.
INTRODUCTION

Obstructive sleep apnea (OSA) is a common sleep disorder characterized by a repetitive partial or complete collapse of the patient’s upper airway, which causes nightly desaturations and disrupted sleep (Chan et al., 2010). The disease has been related to narrow upper airways, obesity and/or male gender (Chan et al., 2010). Sleep apnea can be subcategorized into three different groups: OSA, central sleep apnea (CSA) and mixed OSA (a combination of central and obstructive sleep apnea) with OSA being the far most common one (84%) (Balk et al., 2011). CSA is not caused by obstruction of the airways but by an instability in the feedback mechanism regulating respiration. These diseases are diagnosed in a sleep apnea recording in a sleep clinic where obstructive-, central- and mixed events are identified. The upper airway obstructions are subdivided into apneas and hypopneas, which are counted during the night. An apnea is an interruption of breathing for more than 10 s and a hypopnea is an episode of shallow breathing for more than 10 s. The average number of breathing events per hour of sleep, the apnea-hypopnea index (AHI), is used for the diagnosis of OSA. An AHI of ≥5 defines OSA, where there are three subgroups; mild OSA (AHI<15), moderate OSA (AHI 15-30) and severe OSA (AHI> 30) (Heatley et al., 2013).

In an American adult population of employees an estimated 24% of the males and 9% of the females suffer from OSA (Young et al., 1993). In a recent study of Swedish females, the prevalence of OSA was much higher: 50% (Franklin et al., 2013). Differences in figures might be explained by differences in methodology in measuring the events, study samples or an increase in prevalence of sleep related breathing disorder together with epidemic increases in obesity in many countries (Peppard et al., 2013).

OSA may lead to daytime sleepiness, impaired alertness and an increased risk of depression, increased risk of motor vehicle accidents, cardiovascular disease, high blood pressure, stroke, diabetes and arrhythmias (Chan et al., 2010; Silverberg et al., 2002; El-Ad and Lavie 2005; Yan-fang et al., 2009; Bixler et al., 2008; Leung 2009). The mortality for male patients suffering from severe OSA is increased compared with the general population, since the 8 year survival rate is significantly lower (0.96 ± 0.02 for AHI= <20
vs. 0.63 ± 0.17 for AHI>20 (p<0.05) (He et al., 1988). The disease burden for USA alone was calculated to approximately $3.4 billion in 1999 (Kapur et al., 1999).

Continuous positive airway pressure (CPAP) is an extra oral device that delivers ambient air with positive pressure, which produces a pneumatic splint of the upper airway. This is the most effective treatment for OSA (Chan et al., 2010).

OAs is the main alternative to CPAP. These intraoral devices works by preventing the mandible from dropping back and together with the tongue restrict the air flow in the pharynx. OA is effective in the treatment of patients with mild to moderate disease (Marklund et al., 2012), and has been found to reduce sleep apneas versus a placebo device in all studies (Marklund et al., 2012). Patients comply better and are more satisfied with OA than with CPAP (Ngiam et al., 2013, Marklund et al., 2012, Ferguson et al., 1996). Most OAs are made by dental technicians. One recent type of OA is produced by the CAD-CAM technique and it only covers the posterior teeth. The lateral parts are connected over the frontal areas by bands. Both the OA_F and the OA_R are adjustable OAs. The patients or the dentists are able to adjust the advancement of the lower jaw, usually by tightening or loosening a small screw or replacing lateral bands with shorter or longer ones.

CPAP can cause local side effects from the increased airflow through the nose or pressure in the face, such as nasal congestion or discomfort due to the mask. In the longer term, CPAP can cause craniofacial changes such as retroclination of upper front teeth (Tsuda et al., 2010; Randerath et al., 2011).

OA is fixated to the teeth and jaws and generates forces on the oral structures, when the muscles attempt to move the mandible backwards again (Cistulli et al., 2004). The maxillary incisors are subjected to distal and extrusive forces, and the mandibular incisors are loaded with anteriorly directed forces (Marklund, 2006). After long-term use, OAs cause changes in tooth positions that also might affect mandibular posture (Almeida et al., 2006). The overjet and overbite will decrease (Almeida et al., 2006; Marklund 2006).

In the clinic, one of our patients had noticed that a flexible type of OA had caused a marked buccal inclination of a lower front tooth during only a few months, which was verified by comparison with previous plaster casts. The aim of this study was therefore to evaluate two different OA designs, a more rigid one and a more flexible type.
regarding increased crowding of the lower front teeth. The hypothesis was that the more flexible appliance increased the lower frontal irregularity more than the rigid one.

**MATERIALS AND METHODS**

**Study participants**
Consecutive patients who had received either a rigid type of OA, OA\(_R\) (Somnodent, Somnomed, MAS Nordic, Stockholm)(Figure 1) or a more flexible one, OA\(_F\) (Narval, Resmed, Lyon France)(Figure 2) for the treatment of snoring or obstructive sleep apnea in between January 2011 until December 2011 were considered for inclusion in the study at the time of their two-year follow-up. The follow-up study period was planned from August 2013 to December 2013. Exclusion criteria were: Compliance < 50% of the nights or < 50% of the night, concomitant use of CPAP, alveolar bone loss on the incisor teeth defined as an attachment level that was located more than 3 mm apical to the cementoenamel junction or diseases such as dementia that might interfere with the study protocol.

**Study design**
A retrospective, observational study was designed in order to provide pilot data for a later larger study. Patients who had used either type of appliance during the past two years with as equal treatment time as possible were selected from consecutively treated patients. If there were several possible patients, the patients who were most equal in age were selected.
Their periodontal status was recorded with a periodontal probe. Impressions for plaster casts were taken. The appliances were photographed to give possibilities for later inspection and comparison. The advancement of the lower jaw by the OA at the time of the follow up was recorded and compared to the initial advancement at baseline.
Both the new plaster casts, the plaster casts from the fabrication of the appliance and the questionnaire were coded in order to blind the analyst while measuring and calculating the results. The plaster casts were used to measure the subject’s irregularity of the frontal teeth with Little’s Irregularity Index, spaces between the teeth in the in frontal
upper and lower jaw, the overbite and the overjet. All measures were done twice and the mean value was used in the calculations, in order to reduce the measuring error.

**Questionnaires**

The questionnaire contained questions about the estimated use of the appliances, subjects’ satisfaction and side effects using a visual analog scale from 0 to 10 (Appendix).

**Statistical Analysis**

Wilcoxon matched-pairs signed-rank test was performed to test for changes in the Little’s Irregularity Index frontal areas. Mann-Whitney test for independent samples was used to test for differences in side effects between the two appliance groups (IBM SPSS Statistics 20.0) was used for data analysis. A p-value of less than 0.05 was considered significant. The sample size was calculated to six patients per group in order to evaluate a change in Little’s Irregularity Index of 2 mm with a power of 0.8 and a significance level of p<0.005.

**Literature Search**

The literature search was done using the search engines Google Scholar and Pub Med with one or all of the following keywords: sleep apnea AND oral appliance AND side effects, another search was done with the following keywords: dental treatment need AND irregularity lower jaw. Seventy seven articles were found in the first search and 4 articles were discovered in the second one. No study was found that has evaluated increased frontal crowding from OAs. The most recent articles in the field of obstructive sleep apnea, oral appliances and side effects were chosen. Some additional articles were supplied by the tutor M. Marklund.

**Ethical Considerations**

The Ethics Forum at the Department of Odontology finds that appropriate ethics consideration have been integrated into this degree project. All patients were informed and signed a written consent form. They were informed that participation was entirely voluntary, and that they were free to withdraw participation at any point. The only
differences for the subjects participating in the study was a more thorough follow up than in normal clinical practice as well as responding to the questionnaire. Bite changes that might be undiscovered in the routine clinic, could therefore be addressed. Patients with possible negative effects from OA treatment would receive information about this condition and be treated with another type of OA. The only negative ethical consideration was around 30 min extra time invested by the participants.

RESULTS

Study population
Sixteen patients out of 92 who had received OA_R appliances and 14 patients out of 176 who had got OA_F appliances during 2011 were matched according to treatment time and considered for inclusion in the study. Ten patients from the OA_R group were excluded because of illness (3), too little usage of the device (2), a desire to wait with follow-up (3) or poor baseline study casts (2). Eight patients from the OA_F group were excluded because of too little usage of the device (1), a desire to wait with follow-up (6) or bone loss in the incisor areas (1).

Study outcomes
Baseline characteristics of the sample are presented in Table 1. The mean age for the OA_F group was 62.6 (min-max 37.9-76.0) years and 58.1 (40.1-66.7) years for the OA_R group (p=0.394). Mean treatment time was 2.6 (2.1-2.8) years for the OA_F group and 2.8 (2.5-3.3) years for the OA_R group (p=0.589).

The irregularity of the lower front teeth as measured with Little's Index increased in the OA_F group, while it decreased in the OA_R group (0.89 mm p=0.35 and -0.58 mm p=0.23, respectively; difference between groups p=0.041)(Table 2). The mean overbite in the OA_F group was lower at follow-up, 1.92 mm, compared with baseline, 2.78 mm, p=0.043). There was no significant change in overbite in the OA_R group at follow up, 1.82 mm, versus baseline, 2.20 mm, p=0.25. The change in overbite did not differ between the groups (p=0.394).
The OA_F users had reduced the advancement and the OA_R users had increased the advancement (-0.17 mm and 1.92 mm P=0.004) during the study period (Table 1), but there was no significant difference in final advancement between the groups (p=0.485). The questionnaires regarding satisfaction and side effects of the OA treatment showed no significant differences between the two groups.

**DISCUSSION**

The present pilot study verified our hypothesis that the more flexible OA_F produced a larger increase in irregularity of the lower front teeth than the more rigid OA_R appliance.

The reason for the increase in irregularity could be due to the fact that OA_F is laterally flexible and do not stabilize the frontal teeth. The more rigid OA_R in contrast, held the teeth more in their original position. The forces in both OA_F and OA_R pushing the mandible anteriorly does so by pulling the teeth of the lower jaw anteriorly, and when the frontal teeth are exposed they might be more likely to be displaced when not being fixed in place, relative to the teeth in the upper jaw, by being covered by an OA.

Previous studies have shown that there are decreases in overjet and overbite and that there is a bite change into more mesial types of occlusion (Cistulli et al., 2004). No studies have evaluated the frontal irregularity while using OA.

The OA_F group reduced their mandibular advancement during treatment while the OA_R group increased their mandibular advancement. When measuring the total advancement at follow-up no differences between groups were found. The increased advancement during the study period strengthens our results since an increased movement forward of the lower jaw during a specific period of time might cause larger stress on the teeth and more dental changes. It has been shown that more advancement produces larger forces on the teeth (Cohen-Levy et al., 2013). Previous findings also confirm that a larger advancement will produce larger side effects on other bite characteristics such as overjet (Ferguson et al., 1997). Although the final advancement was the same in the two groups, the more forward movement of the jaw during the study period in the rigid appliance group ought to produce a higher risk for bite changes.
We also found a significant reduction in overbite by the OA$_F$ appliance. The frontal teeth in the OA$_F$ are not covered by OA and thus allow an elongation. Consequently, our findings were opposite towards this suggested effect. Reductions in overbite and overjet as a result of OA use have been observed in several studies (Fransson et al., 2004; Almeida et al., 2006; Rose et al., 2002). It is possible that this finding was found by chance. In addition, we included few patients and the sample size calculation of our study was based on the effects on frontal irregularity.

Patients with malocclusion characterize three major problems: aesthetics, function and speech. (Shaw et al., 2007). The aesthetic part might be the most obvious one, but function and speech are both important to patients. There are currently no studies concerning adults treated by OA afflicted by malocclusion. If this study can improve the design of the OA$_F$ it might help prevent malocclusion and thereby worsening of aesthetics, function and speech.

The treatment of sleep apnea with OA greatly reduces the AHI and thus improving the quality of the patient’s life and reducing illness of untreated disease. The result of the treatment probably outweighs the side effects, but an OA with less side effects is still better. Even though the result is greater than the side effects it is still important to minimize them.

Little’s Irregularity Index is a quantitative tool used to determine and compare the level of irregularity in the upper and lower frontal jaw. The linear distance between two adjacent incisor’s and canine’s contact points is measured and summarized for each jaw (Figure 3). In this study the index is used for adults but it is more commonly used among children (Bernabé and Flores-Mir, 2006). Recently, digital models have been suggested in order to reduce the inter-examiner variability in the measurements (Dowling et al. 2013). In our study there was only one examiner, but in future studies digital measurements should be considered.

The objective measurement of bite changes by Little’s Irregularity Index does not consider a patient’s discomfort from malocclusion. The patients level of discomfort was addressed in the questionnaires. No significant difference in discomfort between the groups was found. This is in accordance with previous studies that show that patients are generally unaware of any bite changes (Marklund et al., 2012).
One limitation with the present study was the small sample size. Our intention was to have ten subjects in each group, in order to increase the power in the results. We had a lot of variables and even though the statistical analysis was done for six subjects, regarding our main outcome variable the Little’s Irregularity Index, more and/or greater differences between the groups might have been discovered.

The best way to evaluate differences in treatment side effects, as done in this study, is by doing a prospective study. The time span for this study was not long enough so a retrospective approach was chosen instead. Furthermore there is at least one big ethical obstacle by doing a prospective study of this kind, the fact that the examiner might discover side effects during the course of the study which may lead to premature finalization of the study with subsequent reduced informative value. The strength of this pilot study was the discovery of increased crowding, despite the small patient sample. This means that it is possible to earlier avoid this side effect for future treatments. It is fairly easy to change the design of the more flexible type of OA, since it is made by CAD-CAM technique.

To prevent OA_F from causing irregularity; either include the frontal teeth as well, thus sharing the anterior force equally between the teeth or by constructing a sturdier frontal component, making it more laterally rigid to better keep the covered teeth in place resulting in less lateral force being applied to the frontal teeth. Both the suggested changes can be combined for a synergistic effect while keeping a slender CAD/CAM design. Most likely, these changes in design will not influence subjects’ treatment satisfaction. The suggested design will be quite similar to the OA_R that was used in our study which was accepted to a similar degree as the more flexible one.

In conclusion, the present results indicate that a flexible type of OA increase the irregularity of the lower front teeth compared with a more rigid OA. The results should be confirmed in a larger sample.

ACKNOWLEDGEMENTS

I wish to thank my tutor Dr Marie Marklund for her help with the data collection, for her help with the writing and for sharing her vast knowledge on the subject.
REFERENCES


Table 1. Baseline characteristics. Gender, age, treatment time and advancement of lower jaw by the OA.

<table>
<thead>
<tr>
<th></th>
<th>OA_F (n=6)</th>
<th>OA_R (n=6)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Min-Max</td>
<td>Mean</td>
</tr>
<tr>
<td>Advancement (mm)</td>
<td>2.63</td>
<td>2.10-2.80</td>
<td>2.83</td>
</tr>
<tr>
<td>Change in</td>
<td>5.00</td>
<td>3.00-8.00</td>
<td>5.92</td>
</tr>
<tr>
<td>advancement (mm)</td>
<td>-0.17</td>
<td>-2.00-1.00</td>
<td>1.92</td>
</tr>
</tbody>
</table>

Advancement is the distance, at follow-up, the OA forces the mandible forward. Change in advancement is the difference in advancement between baseline and follow-up.
Table 2. Dental changes by the OAs, data from baseline and follow up regarding teeth position and dental occlusion. Irregularity, spacing, overjet, and overbite.

<table>
<thead>
<tr>
<th></th>
<th>OAF (n=6)</th>
<th></th>
<th>OA R (n=6)</th>
<th></th>
<th>Difference between groups</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base-line</td>
<td>Follow-up</td>
<td>Change</td>
<td>p-value</td>
<td>Base-line</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>Little’s index lower (mm)</td>
<td>3.66</td>
<td>4.55</td>
<td>0.89</td>
<td>0.35</td>
<td>2.69</td>
<td>2.10</td>
</tr>
<tr>
<td>Little’s index upper (mm)</td>
<td>3.91</td>
<td>3.46</td>
<td>-0.45</td>
<td>0.14</td>
<td>2.07</td>
<td>2.40</td>
</tr>
<tr>
<td>Spacing upper (mm)</td>
<td>0.00</td>
<td>0.12</td>
<td>0.12</td>
<td>0.32</td>
<td>1.40</td>
<td>1.40</td>
</tr>
<tr>
<td>Spacing lower (mm)</td>
<td>0.30</td>
<td>0.34</td>
<td>0.05</td>
<td>0.32</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Overjet (mm)</td>
<td>3.21</td>
<td>3.21</td>
<td>0.00</td>
<td>0.90</td>
<td>2.25</td>
<td>2.30</td>
</tr>
<tr>
<td>Overbite (mm)</td>
<td>2.78</td>
<td>1.92</td>
<td>-0.85</td>
<td>0.04</td>
<td>2.20</td>
<td>1.82</td>
</tr>
</tbody>
</table>

Little’s index is a tool for measuring irregularity in the frontal part of the jaw. Spacing is the sum of open spaces between frontal teeth.
Table 3. Questionnaire answers from patients regarding satisfaction of effects, side effects and usage of OA at follow-up.

<table>
<thead>
<tr>
<th></th>
<th>OA&lt;sub&gt;F&lt;/sub&gt;</th>
<th></th>
<th>OA&lt;sub&gt;R&lt;/sub&gt;</th>
<th></th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Range</td>
<td>Median</td>
<td>Range</td>
<td></td>
</tr>
<tr>
<td>Overall Satisfaction</td>
<td>3.00</td>
<td>2.00 – 3.00</td>
<td>2.00</td>
<td>2.00 – 3.00</td>
<td>0.09</td>
</tr>
<tr>
<td>Snore Satisfaction</td>
<td>2.00</td>
<td>1.00 – 3.00</td>
<td>2.00</td>
<td>1.00 – 3.00</td>
<td>0.93</td>
</tr>
<tr>
<td>Day tired Satisfaction</td>
<td>2.00</td>
<td>1.00 – 3.00</td>
<td>2.00</td>
<td>2.00 – 3.00</td>
<td>0.61</td>
</tr>
<tr>
<td>Percentage Usage (%)</td>
<td>100.00</td>
<td>80.00 – 100.00</td>
<td>90.00</td>
<td>60.00 – 100.00</td>
<td>0.11</td>
</tr>
<tr>
<td>Time/Night Usage (h)</td>
<td>7.00</td>
<td>5.00 – 9.00</td>
<td>7.00</td>
<td>3.00 – 9.00</td>
<td>0.92</td>
</tr>
<tr>
<td>Rubber band Usage</td>
<td>2.00</td>
<td>0.00 – 2.00</td>
<td>1.00</td>
<td>0.00 – 2.00</td>
<td>0.41</td>
</tr>
<tr>
<td>Side effects</td>
<td>2.50</td>
<td>2.00 – 3.00</td>
<td>2.50</td>
<td>2.00 – 3.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

The Satisfaction values represent how satisfied the subject was from 0 being not satisfied, 1 partially satisfied, 2 satisfactorily, 3 totally satisfied. The side effects value represent how often the subjects had experienced side effects, 0 being often, 1 pretty often, 2 seldom and 3 never. Rubber band Usage values represent how often the subject used rubber bands with their OA, 0 being never, 1 being sometimes and 2 being always.
Figure 1a. The Somnodent appliance (OAₐ)

Figure 1b. The Narval appliance (OAₑ)
Figure 2a

Figure 2b. The pictures show photos of the lower jaw of the subject with the greatest increase in crowding. Little's Irregularity Index was calculated from the summarized distances between the contacts points between two adjacent teeth in the frontal areas. The contact points can be seen marked with a pen in the pictures.
Enkät efter 2 års behandling med oral apparatur (OA) mot sömnnapné

1. Är du nöjd med behandlingen (med oral apparatur) i sin helhet?
   - O Ja, helt och hållet
   - O Ja, i tillräcklig omfattning
   - O Nej, bara till viss del, ej tillräckligt
   - O Nej, inte alls
   - O Vet ej

2. Är du nöjd med behandlingens (med oral apparatur) effekter på snarkning?
   - O Ja, helt och hållet
   - O Ja, i tillräcklig omfattning
   - O Nej, bara till viss del, ej tillräckligt
   - O Nej, inte alls
   - O Vet ej

3. Är du nöjd med behandlingens (med oral apparatur) påverkan på dagtrötthet?
   - O Ja, helt och hållet
   - O Ja, i tillräcklig omfattning
   - O Nej, bara till viss del, ej tillräckligt
   - O Nej, inte alls
   - O Vet ej

4. Försök uppskatta hur många % av nätterna du har använt din oral apparatur sedan behandlingen påbörjades? (Ringa in tillämpligt alternativ)

<table>
<thead>
<tr>
<th>100 %</th>
<th>90 %</th>
<th>80 %</th>
<th>70 %</th>
<th>60 %</th>
<th>50 %</th>
<th>40 %</th>
<th>30 %</th>
<th>20 %</th>
<th>10 %</th>
<th>0 %</th>
</tr>
</thead>
</table>

5. Hur många timmar/natt uppskattar du att du brukar använda apparaturen?
   - > 10 tim
   - 8-10 tim
   - 6-8 tim
   - 4-6 tim
   - 2-4 tim
   - < 2 tim

6. Använder du gummiband till din orala apparatur för att hålla ihop käkarerna?
   - O Alltid
   - O Ibland
   - O Aldrig
7. Har du använt någon annan behandling mot snarkning eller sömnapné sedan du börjat behandlingen med oral apparatur?

☐ O Nej
☐ O Ja

Om ja, vilken?____________________

8. Hur ofta upplever du biverkningar orsakade av behandlingen med oral apparatur?

☐ O Ofta
☐ O Ganska ofta
☐ O Sällan
☐ O Aldrig

9. I vilken grad har biverkningarna påverkat behandlingen?

☐ O Mycket
☐ O Ganska mycket
☐ O Ganska lite
☐ O Inget alls

Besväras du av något av följande? (Markera med kryss längs linjen)

<table>
<thead>
<tr>
<th>Inte alls</th>
<th>Mycket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ömma tänder</td>
<td>__________________________</td>
</tr>
<tr>
<td>Ömma käkar</td>
<td>__________________________</td>
</tr>
<tr>
<td>Rörliga tänder</td>
<td>__________________________</td>
</tr>
<tr>
<td>Förändrat bett</td>
<td>__________________________</td>
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<tr>
<td>Problem att tugga mat</td>
<td>__________________________</td>
</tr>
</tbody>
</table>

20
Nästäppa

Ökad salivutsöndring

Irritation på läppar, kinder, tunga eller tandkött?

<table>
<thead>
<tr>
<th>10. Om du upplever du att dina tänders har ändrats, på vilket sätt och hur mycket har de ändrats då? (Markera med kryss längs linjen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ojämna framtänder i överkäken</td>
</tr>
<tr>
<td>Ojämna tänder i underkäken</td>
</tr>
<tr>
<td>Lutande tänder i överkäken</td>
</tr>
<tr>
<td>Lutande tänder i underkäken</td>
</tr>
<tr>
<td>Ojämnn sammanbitning (utan skena) på morgonen</td>
</tr>
<tr>
<td>Ojämnn sammanbitning (utan skena) under första delen av dagen</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inte alls</th>
<th>Mycket</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ojämn sammanbitning
(utan skena) under hela dagen

Beskriv gärna:

11. Har du själv korrigerat den orala apparaturens grad av framflyttning, och i så fall hur?
   O Inte ändrat
   O Ökat framflyttning
   O Minskat framflyttning

12. Övriga kommentarer: