



# PP18: IMPACT OF ORTHODONTIC ALIGNERS ON SPEECH AND OTHER ORAL FUNCTIONS

**Vasoglou G<sup>1</sup>, Angelopoulos G<sup>1</sup>, Sifakakis I<sup>1</sup>**

<sup>1</sup>Department of Orthodontics, School of Dentistry, National and Kapodistrian University of Athens, Greece

## Aim

To explore the impact of Invisalign aligners on oral function, experienced by patients and the speech disturbances, evaluated by professionals, during the initial treatment phase.

## Materials and Method

Adult patients undergoing orthodontic treatment with aligners were asked to pronounce (repetitively thrice) 5 words and standardized short videos were taken for the evaluation of speech at different time-points. Speech clarity was evaluated by three investigators through a 5-point Likert Scale. Additionally, they filled out a validated health-related quality of life questionnaire (HRQL). Data were statistically analyzed through linear random effects models and F-tests.

### Questions 1-2

1. Assess the **pain** you felt in the following scale :

1=no pain      10= extremely intense pain

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

2. Did you take **medication** to deal with the pain;

Yes      No

Speech assessment through pronunciation of 5 words:

Mississippi  
Suzuki  
Patala  
Emma  
Diesel  
Sofia

Likert Index for evaluation of pronouncing each

examined letter :

1 –not at all  
2–barely  
3–averagely  
4–much  
5–very much

### Questions 3-17

Material & Methods

3. Was it difficult to <b>talk</b> today?	1 2 3 4 5
4. Was it difficult to <b>swallow</b> today?	1 2 3 4 5
5. Was it difficult to <b>open your mouth</b> today?	1 2 3 4 5
6. Was there <b>food</b> that you could not eat today?	1 2 3 4 5
7. Did you had difficulty to enjoy your <b>food</b> today?	1 2 3 4 5
8. Did you observe any change in your <b>taste</b> ?	1 2 3 4 5
9. Was it difficult to <b>sleep</b> last night?	1 2 3 4 5
10. Were you disturbed by your orthodontic appliances in your <b>work or reading</b> ?	1 2 3 4 5
11. Did you performed with difficulty <b>your everyday procedures</b> ?	1 2 3 4 5
12. Do you have <b>tongue injuries</b> ?	1 2 3 4 5
13. Do you have <b>injuries inside your cheeks</b> ?	1 2 3 4 5
14. Do you have <b>injuries inside your lips</b> ?	1 2 3 4 5
15. Did you notice <b>smelliness</b> or bad taste in your mouth?	1 2 3 4 5
16. Did you notice <b>food residues</b> in your orthodontic appliance?	1 2 3 4 5
17. Did you notice change in the <b>color of your teeth</b> ?	1 2 3 4 5

Five-point answer scale for questions 3-17:

1= never  
2= few times  
3= some times  
4= enough times  
5= many times

	Baseline (N=21)	Right after (N=21)	After 1 month (N=21)	After 4 months (N=21)	After 6 months (N=11)	After 8 months (N=9)
Pain (Q1) [1-10]						
Mean (SD)	1.0 (0.0)	4.2 (2.0)	2.4 (2.0)	2.4 (1.8)	2.8 (2.3)	2.8 (1.4)
Min-Max	1.0-1.0	1.0-8.0	1.0-9.0	1.0-8.0	1.0-7.0	1.0-5.0
Q3						
Mean (SD)	1.0 (0.0)	2.2 (1.0)	1.6 (0.7)	1.4 (0.6)	1.7 (1.0)	1.9 (0.5)
Min-Max	1.0-1.0	1.0-5.0	1.0-3.0	1.0-3.0	1.0-3.5	1.0-3.0
Q4						
Mean (SD)	1.0 (0.0)	1.4 (0.6)	1.0 (0.2)	1.0 (0.1)	1.1 (0.3)	1.1 (0.3)
Min-Max	1.0-1.0	1.0-3.0	1.0-2.0	1.0-1.5	1.0-2.0	1.0-2.0
Q5						
Mean (SD)	1.0 (0.0)	1.2 (0.4)	1.1 (0.3)	1.0 (0.2)	1.0 (0.2)	1.1 (0.3)
Min-Max	1.0-1.0	1.0-2.0	1.0-2.0	1.0-1.5	1.0-1.5	1.0-2.0
Q6						
Mean (SD)	1.0 (0.0)	3.2 (1.3)	1.9 (1.1)	1.8 (1.1)	1.6 (1.0)	1.2 (0.4)
Min-Max	1.0-1.0	1.0-5.0	1.0-5.0	1.0-4.0	1.0-4.0	1.0-2.0
Q7						
Mean (SD)	1.0 (0.0)	3.2 (1.3)	2.8 (1.5)	2.2 (1.4)	1.6 (1.1)	1.8 (1.5)
Min-Max	1.0-1.0	1.0-5.0	1.0-5.0	1.0-5.0	1.5-4.5	1.0-5.0
Q8						
Mean (SD)	1.0 (0.0)	1.6 (0.8)	1.5 (1.0)	1.3 (0.5)	1.5 (0.7)	1.8 (1.4)
Min-Max	1.0-1.0	1.0-3.0	1.0-4.0	1.0-3.0	1.0-3.0	1.0-5.0
Q9						
Mean (SD)	1.2 (0.4)	1.5 (0.7)	1.4 (1.1)	1.4 (1.0)	1.0 (0.2)	1.0 (0.0)
Min-Max	1.0-2.0	1.0-3.0	1.0-5.0	1.0-5.0	1.0-1.5	1.0-1.0
Q10						
Mean (SD)	-	2.3 (1.4)	1.7 (1.1)	1.6 (0.7)	1.8 (0.8)	2.0 (1.0)
Min-Max	-	1.0-5.0	1.0-5.0	1.0-3.0	1.0-3.0	1.0-3.5
Q11						
Mean (SD)	1.0 (0.0)	1.7 (1.0)	1.5 (1.0)	1.2 (0.5)	1.3 (0.5)	1.3 (0.4)
Min-Max	1.0-1.0	1.0-4.0	1.0-5.0	1.0-2.5	1.0-2.0	1.0-2.0
Q12						
Mean (SD)	1.0 (0.0)	1.4 (1.0)	1.2 (0.4)	1.4 (0.7)	1.3 (0.6)	1.4 (0.7)
Min-Max	1.0-1.0	1.0-5.0	1.0-2.0	1.0-3.0	1.0-3.0	1.0-3.0
Q13						
Mean (SD)	1.0 (0.0)	1.8 (1.2)	1.5 (0.7)	1.6 (0.9)	1.6 (1.0)	1.7 (0.9)
Min-Max	1.0-1.0	1.0-5.0	1.0-4.0	1.0-4.0	1.0-4.0	1.0-3.0
Q14						
Mean (SD)	1.0 (0.0)	1.9 (1.2)	1.4 (0.9)	1.2 (0.4)	1.5 (0.9)	1.4 (0.7)
Min-Max	1.0-1.0	1.0-5.0	1.0-5.0	1.0-2.0	1.0-3.5	1.0-3.0
Q15						
Mean (SD)	1.0 (0.0)	1.4 (0.7)	1.5 (0.7)	1.5 (0.7)	1.3 (0.5)	1.9 (1.1)
Min-Max	1.0-1.0	1.0-4.0	1.0-3.0	1.0-3.0	1.0-2.0	1.0-4.0
Q16						
Mean (SD)	-	1.6 (0.9)	1.6 (0.9)	1.8 (1.0)	1.5 (0.7)	2.1 (1.4)
Min-Max	-	1.0-4.5	1.0-4.0	1.0-5.0	1.0-3.0	1.0-5.0
Q17						
Mean (SD)	1.0 (0.0)	1.1 (0.3)	1.5 (1.0)	1.7 (1.0)	1.6 (0.9)	2.0 (1.1)
Min-Max	1.0-1.0	1.0-2.0	1.0-5.0	1.0-4.0	1.0-3.5	1.0-4.0
HRQoL score (Q3-Q17) [1-5]						
Mean (SD)	1.0 (0.0)	1.8 (0.4)	1.5 (0.4)	1.5 (0.4)	1.4 (0.5)	1.6 (0.3)
Min-Max	1.0-1.1	1.0-1.1	1.0-2.7	1.0-2.2	1.0-2.3	1.0-2.1

Table 2. Summary statistics of HRQoL Q1, Q3-Q17 & HRQoL score (Q3-Q17) by timepoint .

	p-value
Pain (Q1) [1-10]	<0.001
Q3	<0.001
Q4	0.003
Q5	0.371
Q6	0.001
Q7	<0.001
Q8	0.063
Q9	0.485
Q10	0.038
Q11	0.017
Q12	0.211
Q13	0.040
Q14	0.008
Q15	0.008
Q16	0.523
Q17	0.003
(Q3-Q17) [total]	<0.001

Table 3. Type 3 Tests of the effect of time on HRQoL questionnaire Q1, Q3-Q17 & HRQoL score (Q3-Q17) from random effects models . Q1, Q3, Q4, Q6, Q7, Q10, Q11, Q13, Q14, Q15, Q17 & HRQoL score (Q3-Q17) are significantly associated with time.

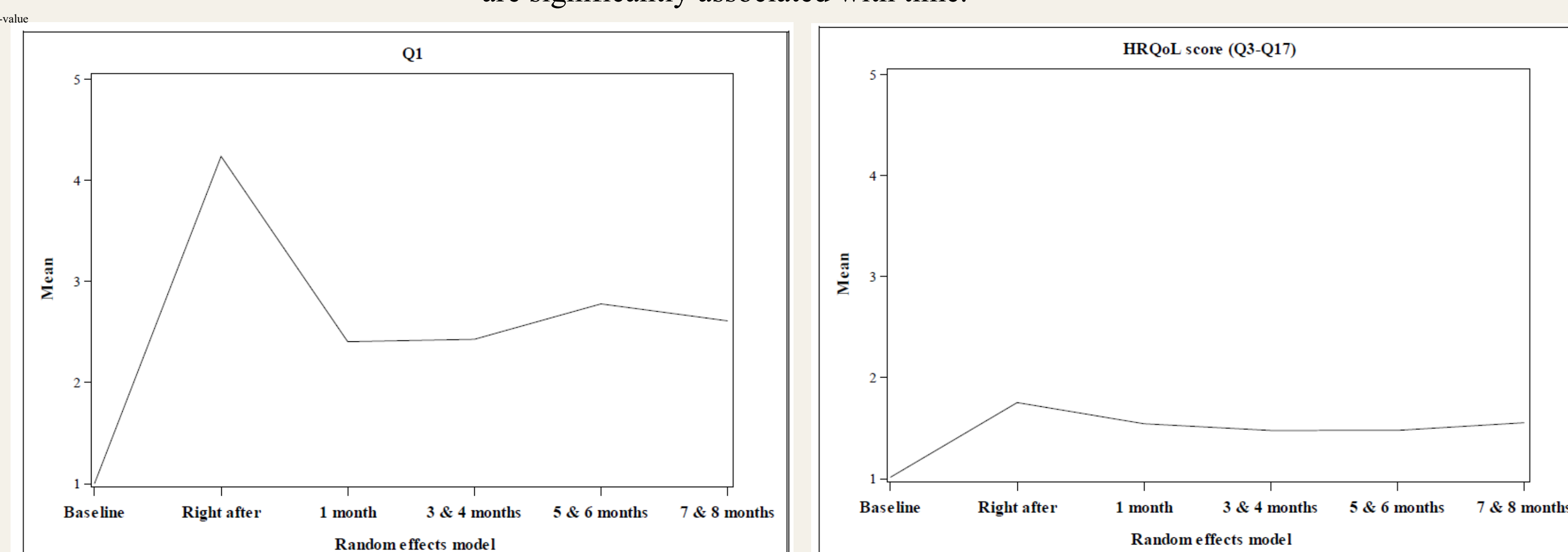


Fig.1 Estimated mean HRQoL Q1 (Pain) from random effects model

Figure 2. Estimated mean HRQoL score Q3-Q17 from random effects model

## Results

The level of pain (Q1) increases at the beginning of the treatment and gradually decreases after the first month. Difficulties in speech (Q3), swallowing (Q4), eating certain foods (Q6) and in everyday activities (Q11) as well as food pleasure (Q7), lip trauma (Q14) and bad taste (Q15) are also significantly associated with time as average scores increase right after placement and decrease after 4 months of treatment. Some patients notice a subtle change in the color of their teeth after 3 months (Q17). Consonants /s/ and /z/ are mainly affected after placement of the appliance. Speech disturbances recover after 3 to 6 months.

	p-value
<b>Word 1 (Mississippi)</b>	
/s/	<0.001
<b>Word 2 (Suzuki)</b>	
/s/	<0.001
/z/	<0.001
<b>Word 5 (Diesel)</b>	
/z/	<0.001
<b>Word 6 (Sofia)</b>	
/s/	<0.001
/f/	<0.001

Table 1. F-tests for the effect of time on average speech evaluation ratings from random effects models [only for affected letters]

## Conclusions

Orthodontic treatment with aligners mildly affects oral functions and quality of life during the initial months of treatment.

## References

Shalish M1, Cooper-Kazaz R, Ivgi I, Canetti L, Tsur B, Bachar E, Chaushu S.: Adult patients' adjustability to orthodontic appliances. Part I: a comparison between Labial, Lingual, and Invisalign™. Eur J Orthod. 2012 Dec;34(6):724-30.

Cooper-Kazaz R 1, Ivgi I, Canetti L, Bachar E, Tsur B, Chaushu S, Shalish M. The Impact of Personality on Adult Patients' Adjustability to Orthodontic Appliances. Angle Orthod 2013, 83 (1), 76-82