

Effect of Weight-Loss on Tongue Fat And Upper Airway Structures

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Note: 2 pages

RATIONALE

Enlargement of the soft palate, tongue, and lateral pharyngeal walls are risk factors for obstructive sleep apnea (OSA). Tongue fat has been shown to be important in the pathophysiology of OSA and can be objectively measured using Dixon MRI. Significant improvements in OSA have been reported in obese patients following weight-loss; however the underlying changes in upper airway soft tissues are still unclear. This study investigated soft tissue changes in the upper airway following weight-loss.

METHODS

43 obese subjects underwent a sleep study and upper airway MRI. After 6 months, subjects returned for follow-up measurements. Subjects were categorized as weight-loss if $\geq 5\%$ of their initial weight was lost ($n = 20$, mean age 44.4 ± 13.8 years, mean weight change $-13.28 \pm 6.87\%$; baseline vs. follow-up means: weight 113 ± 28 vs. 97 ± 21 kg, BMI 38.8 ± 7.8 vs. 33.4 ± 5.5 kg/m², AHI 39.0 ± 29.7 vs. 19.8 ± 21.2 events/hour) or weight stable if they differed $< 5\%$ of their initial weight ($n = 23$, mean age 48.2 ± 11.3 years, mean weight change $-0.76 \pm 2.94\%$; baseline vs. follow-up means: weight 113 ± 27 vs. 112 ± 28 kg, BMI 39.4 ± 8.5 vs. 38.7 ± 8.9 kg/m², AHI 31.7 ± 31.8 vs. 27.4 ± 23.6 events/hour). Volumetric analysis was performed on axial T1 spin echo and Dixon MR images using Amira 5.4.3. Comparisons were made using paired t-tests.

RESULTS

Weight-loss subjects showed significantly greater decreases in total soft tissue ($-7.70 \pm 7.5\%$, $p = 0.0043$), tongue fat ($-23.2 \pm 15.82\%$, $p < 0.0001$), parapharyngeal fat pad volume ($-31.29 \pm 14.4\%$, $p < 0.0001$), and lateral pharyngeal wall volume ($-9.08 \pm 12.1\%$, $p = 0.0108$) than weight stable subjects (Table 1). Tongue volume ($p = 0.40$) reduction was greater in weight-loss subjects but not significant. Soft palate ($p = 0.88$) changes did not differ between groups. Changes in weight ($p < 0.0001$), BMI ($p < 0.0001$), and AHI ($p = 0.02$) were significantly greater in weight-loss subjects.

DISCUSSION

Subjects with greater than 5% initial weight-loss showed significant decreases in tongue fat and lateral pharyngeal wall volume. These losses, when combined with other soft tissue changes, contributed to improvements in AHI; however, reductions in parapharyngeal fat pads did not appear to independently play a role in those improvements. These data suggest that reductions in tongue fat and lateral pharyngeal wall volume may explain the mechanism behind AHI improvement following weight-loss.

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Differences in 6 Month Changes Between Weight Stable and Weight-Loss Groups

Measure	Absolute Change*			Percent Change*		
	Weight Stable (n=23)	Weight-Loss (n=20)	p [†]	Weight Stable (n=23)	Weight-Loss (n=20)	p [†]
Weight (kg)	-1.65 ± 7.26	-35.28 ± 23.95	<0.0001	-0.76 ± 2.94	-13.28 ± 6.87	<0.0001
BMI (kg/m ²)	-0.38 ± 1.07	-5.45 ± 3.73	<0.0001	-1.02 ± 2.81	-13.27 ± 6.87	<0.0001
AHI (events/hour)	-4.34 ± 18.70	-19.15 ± 20.52	0.0185	34.1 ± 138.2	-44.2 ± 50.7	0.0173
Total Soft Tissue (mm ³)	-4043 ± 12704	-15796 ± 16392	0.0034	-2.17 ± 7.01	-7.70 ± 7.51	0.0043
Soft Palate (mm ³)	-360 ± 1529	-369 ± 1414	0.9802	-2.5 ± 16.95	-3.12 ± 16.18	0.8838
Genioglossus (mm ³)	-2520 ± 6728	-5061 ± 9742	0.2610	-2.28 ± 6.89	-4.79 ± 9.65	0.2667
Tongue Fat (mm ³)	-208 ± 2653	-6387 ± 4485	<0.0001	-0.47 ± 9.14	-23.2 ± 15.82	<0.0001
Total Tongue Volume (mm ³)	-2883 ± 10417	-7694 ± 12547	0.1155	-2.06 ± 7.91	-5.42 ± 8.86	0.1263
Fat Pads (mm ³)	-284 ± 1096	-2102 ± 1557	<0.0001	-5.04 ± 17.64	-31.29 ± 14.35	<0.0001
Total Lateral Walls (mm ³)	-369 ± 2463	-2493 ± 3248	0.0070	-1.49 ± 12.58	-9.08 ± 12.09	0.0180

*Estimates presented as mean ± standard deviation change from baseline; †p-value from T-test