



VANDERBILT-INGRAM CANCER CENTER

Longitudinal Audiologic Assessment in Single and Fractionated Stereotactic Radiosurgery for Vestibular Schwannoma

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Background

- Fractionated SRS for VS has been theorized to allow for tumor control with higher rates of hearing preservation in selected patients with useful hearing, though this remains controversial.
- There is limited data with formal audiologic measures of hearing preservation to support the standard use of fractionated SRS in VS.
- We hypothesized that fractionation would diminish the amount of hearing damage to both cochlea and CN8 given lower alpha/beta ratio compared to tumor
- We aimed to evaluate this possible relationship between audiologic performance and SRS fractionation scheme in patients treated with 1, 3 or 5 fraction radiosurgery for VS.
- Pre-post SRS SAT was obtained and normalized to contralateral ear hearing after treatment with a Novalis Tx Linear Accelerator (with ExacTrac Localization and iPlan TPS).

VS patients treated with SRS

TABLE 1. Patient Clinicopathologic Characteristics Reported as Median (Interquartile Range)

Fraction	1 (n = 12)	3 (n = 12)	5 (n = 31)	P value
Age (yr)	74(14.5)	58.5(17.5)	65(18.5)	.2
Dose (cGy)	1250(37.5)	700(0)	450(50)	.12
Female Sex	6(50)	8(66.6)	20(64.5)	.62
Baseline tumor volume (cm ³)	0.745(0.9)	1.42(2.36)	2.13(3.19)	.03

Kruskal–Wallis testing was used to compare the three groups.

TABLE 2. Serviceable Hearing by Treatment Scheme Before and After SRS

	% Yes	% No	χ^2	Cramer's V
Evaluable hearing at baseline			6.762*	0.347*
1 Fraction	12 (100)	0 (0)		
3 Fractions	8 (67)	4 (33)		
5 Fractions	29 (91)	3 (9)		
Serviceable hearing at baseline			4.074	0.270
1 Fraction	5 (42)	7 (58)		
3 Fractions	6 (50)	6 (50)		
5 Fractions	23 (72)	9 (28)		
Serviceable hearing post-RT			1.167	0.144
1 Fraction	5 (42)	7 (58)		
3 Fractions	5 (42)	7 (58)		
5 Fractions	18 (56)	14 (44)		
Functional decline in serviceable hearing			4.512	0.284
1 Fraction	1 (8)	11 (92)		
3 Fractions	3 (25)	9 (75)		
5 Fractions	13 (41)	19 (59)		
Serviceable hearing at follow-up			1.722	0.175
1 Fraction	5 (42)	7 (58)		
3 Fractions	5 (42)	7 (58)		
5 Fractions	19 (59)	13 (41)		

*P < .05.

$$\text{Corrected change from baseline} = (I_{ix} - I_{i0}) - (I_{cx} - I_{c0})$$

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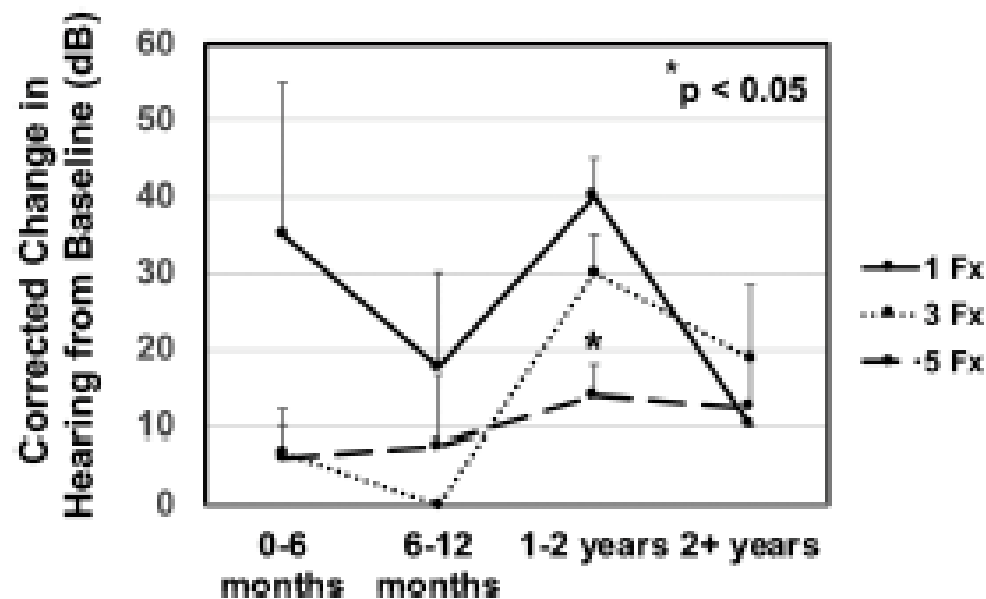
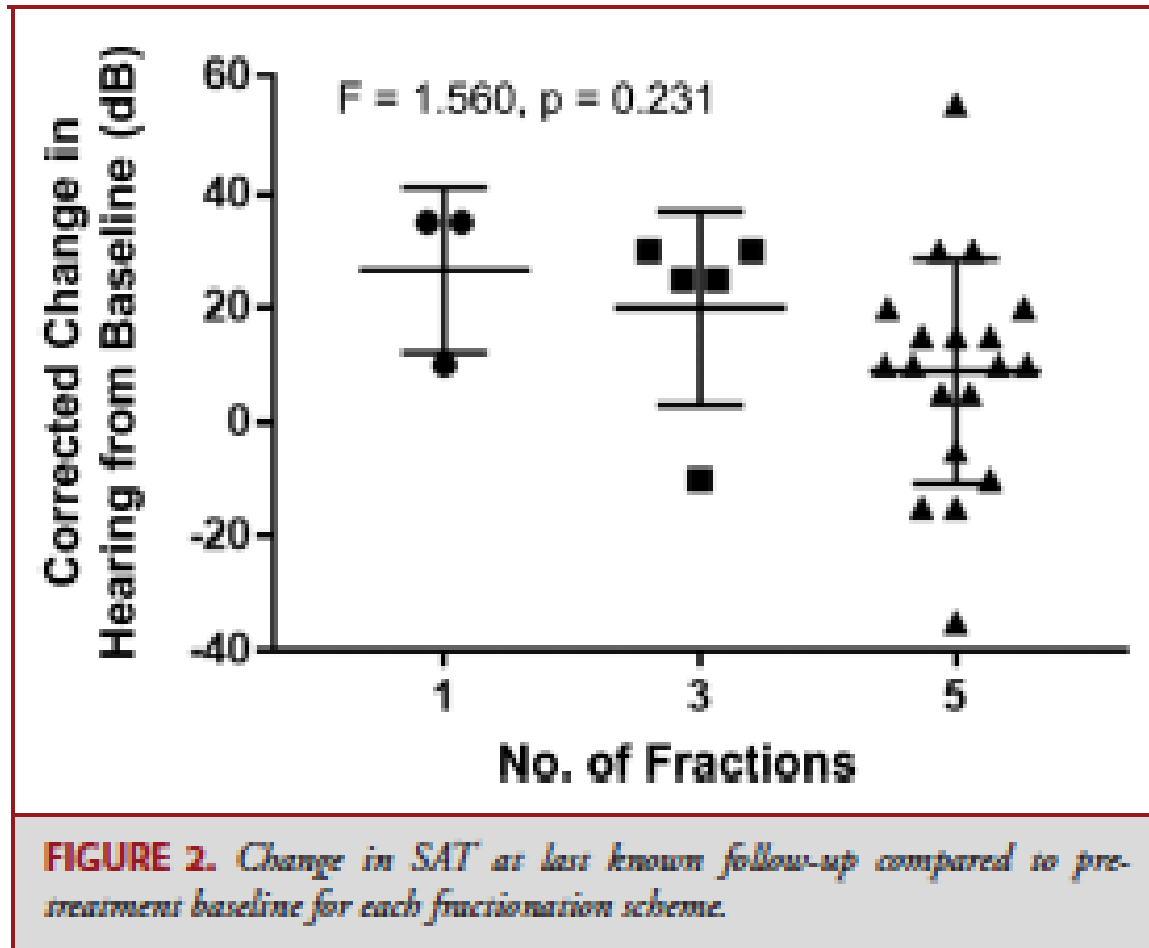


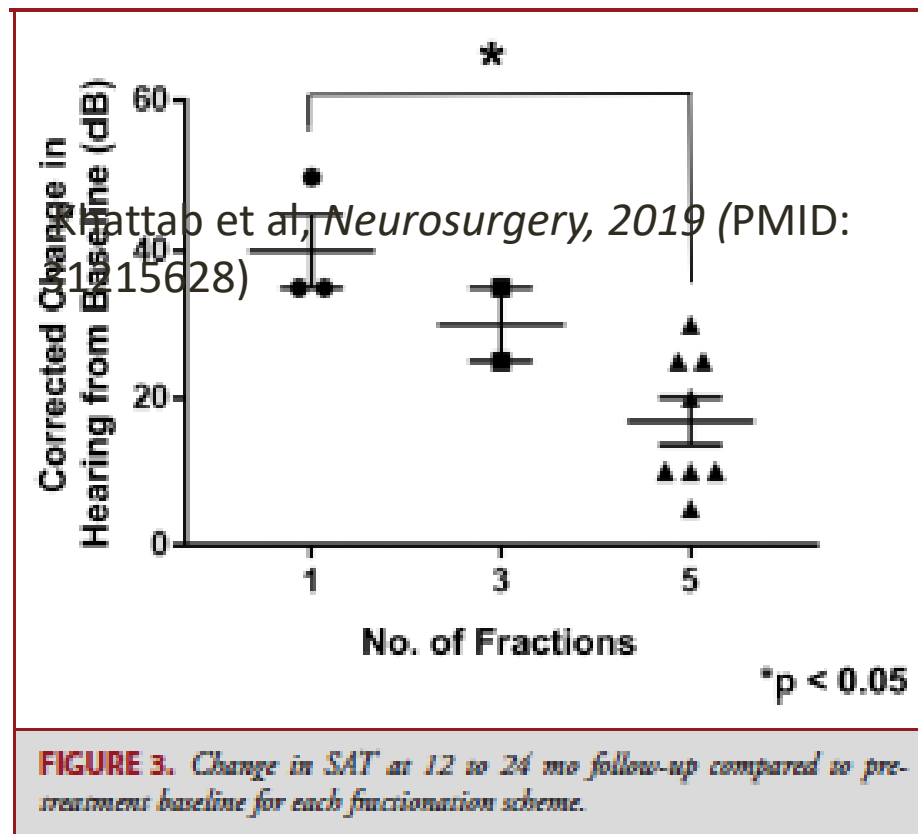
FIGURE 1. Plot of SAT over time per fractionation scheme. * indicates significant difference in audiologic outcomes at 1 to 2 yr between 5 fraction and 1 and 3 fraction groups via ANOVA with post-hoc analysis.

Change in hearing at last known follow-up: A trend is observed

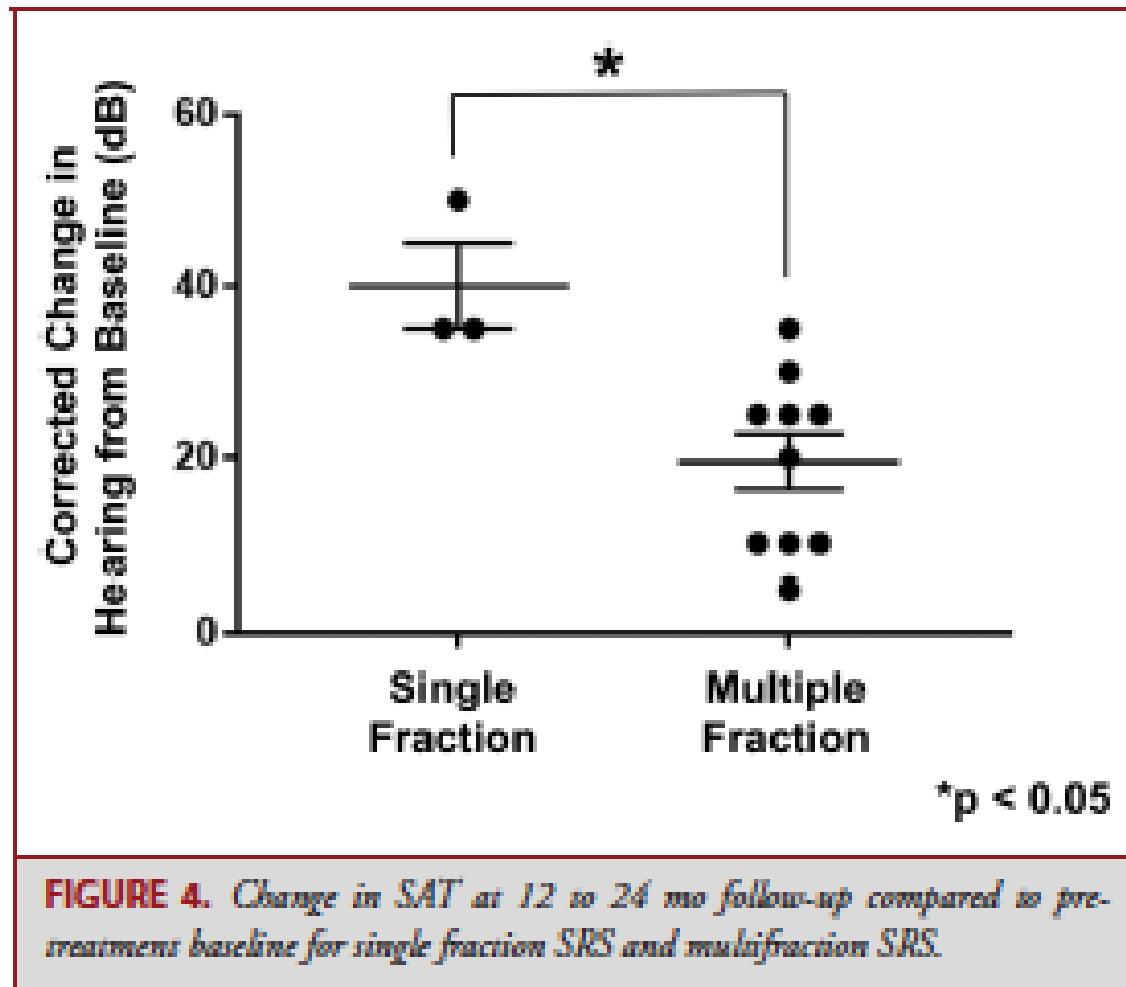


Change in hearing at 1-2 years:

Largest amount of audiologic data was captured at 12 to 24 months, and when change in SAT was compared at this time point, it demonstrated a statistically significant finding in hearing outcome.



Significance maintained when comparing 1-fx to multi-fx cohorts at 1-2 years:



Cochlear dose not a driver of observed differences:

TABLE 3. Cochlear Mean Dose and Cochlear 0.035 Cc Point Max Dose by Fraction Group Reported as Median (Min-Max)

Fractions	Cochlear mean dose	Cochlear 0.035 cc point max
1	10.49 (6.75-10.99)	12.72 (9.88-12.73)
3	13.07 (11.40-14.73)	16.84 (13.44-20.24)
5	15.34 (2.89-19.50)	17.85 (3.51-22.18)

Conclusions:

- SAT is an important audiologic metric that can be used to quantitatively track hearing outcomes, with easy correction for presbycusis
- Though our data are limited by a small sample size and biases common to retrospective reviews, they did show statistical significant hearing preservation (based on increased SAT) with fractionation.
- This data support a randomized prospective trial to confirm the results this retrospective review suggests.