Comparing Post-Operative Complications Associated with Bone-Anchored Hearing Aid (Baha®) Connect and Attract Implantation in Pediatric Patients

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Background

- Bone anchored hearing aid (Baha®) devices are bone conduction hearing implants which rely on the concept of osseointegration.
- Children suffering from hearing loss are at a significant disadvantage to their peers regarding social interactions, education, safety, and communication skills development.
- Conductive hearing loss is often seen in children with conditions such as chronic ear disease (chronic ear drainage), isolated atresia, chronic suppurative otitis media, ear canal stenosis, ossicular disease, and children with congenital malformations such as Treacher-Collins syndrome, Goldenhar syndrome, or Down syndrome.[1] Other otologic indications for Baha® implantation surgery include patients suffering from single-sided deafness and patients who have cochlear insufficiency in one ear along with conductive hearing loss in the other ear.[2]
- Previous studies of Baha® device implantation have found a high rate of postoperative complications in pediatric populations, showing that up to 44% may require revision surgery.[3]
- Although Baha® has since released multiple variations of their device, the Connect and Attract, and the difference in complication rates between the two devices in children has not been extensively explored.

Hypothesis

- Attract has a lower complication rate than Connect and requires fewer revision procedures. Parental satisfaction rate and quality of life measures in Attract devices will be higher than in Connect devices.

Methods

- 19-year retrospective chart review of patients ages 1 through 21 who underwent a Baha® Connect or Attract implantation for conductive hearing loss from 2001 to 2020 at Children's Hospital Colorado.
- Chart review was performed on each participant and information regarding demographic and clinical data during their pre and post operative period was analyzed.
- Complications were divided into minor, moderate and major categories. Minor was defined as no medication or surgery needed. Moderate was defined as the need for medication or minimal outpatient treatment. Major was defined as the need for surgical revision.
- Additionally, a survey was performed among parents over the phone and via REDCap email invitation.

Results

TABLE 1.
Demographic Characteristics and Clinical Determinants of the Study Population

Total Number of Subjects			115
	Connect (n=45)	**Attract (n=70)**	**P-Value**
Sex, No. (%)			.866
Male	25 (55.6)	40 (57.1)	
Female	20 (44.4)	30 (42.9)	
Ethnicity, No. (%)			.605
Non Hispanic or Latino	27 (60.0)	36 (51.4)	
Hispanic or Latino	17 (37.8)	31 (44.3)	
Unknown	1 (2.2)	3 (4.3)	
Race, No. (%)			.298
Asian	4 (8.9)	4 (5.7)	
Black	3 (6.7)	1 (1.4)	
Native American	1 (2.2)	2 (2.9)	
White	24 (53.3)	32 (45.7)	
Other	13 (28.9)	31 (44.3)	
Indication, No. (%)			.213
Conductive	33 (73.3)	60 (85.7)	
Sensorineural	5 (11.1)	6 (8.6)	
Mixed	4 (8.9)	1 (1.4)	
Unspecified	3 (6.7)	3 (6.7)	
Surgey ear, No. (%)			.143
Left	18 (40.0)	16 (22.9)	
Right	16 (35.6)	33 (47.1)	
Bilateral	11 (24.4)	21 (30.0)	
Age (years) at time of implantation			.733
Mean (SD)	8.9 (4.4)	8.7 (3.7)	
Age (years) at time of implantation, No. (%)			.902
2-5	9 (20.0)	13 (18.6)	
6-10	22 (48.9)	39 (55.7)	
11-15	9 (20.0)	12 (17.1)	
16-19	5 (11.1)	6 (8.6)	

TABLE 2.
Number of Patients Experiencing Postoperative Complications by Severity

	Connect (n=45)	**Attract (n=70)**	**P-Value**
Minor Complications, No. (%)			.014
0	23 (51.1)	46 (65.7)	
1	12 (26.7)	19 (27.1)	
2	8 (17.8)	3 (4.3)	
3	1 (2.2)	1 (1.4)	
4	1 (2.2)	1 (1.4)	
≥5	0 (0.0)	0 (0.0)	
Moderate Complications, No. (%)			<.0001
0	15 (33.3)	57 (81.4)	
1	15 (33.3)	10 (14.3)	
2	5 (11.1)	2 (2.9)	
3	8 (17.8)	0 (0.0)	
4	2 (4.4)	0 (0.0)	
≥5	0 (0)	1 (1.4)	
Major Complications, No. (%)			<.0001
0	20 (44.4)	62 (88.6)	
1	15 (33.3)	8 (11.4)	
2	7 (15.6)	0 (0.0)	
3	3 (6.7)	0 (0.0)	
4	0 (0.0)	0 (0.0)	
≥5	0 (0.0)	0 (0.0)	
Any Complications, No. (%)			<.0001
0	4 (8.9)	35 (50.0)	
1	9 (20.0)	21 (30.0)	
2	5 (11.1)	8 (11.4)	
3	8 (17.8)	3 (4.3)	
4	8 (17.8)	2 (2.9)	
≥5	11 (24.4)	1 (1.4)	

TABLE 3.
Odds Ratio of Postoperative Complications

	Connect	**Attract**	**Odds Ratio (95% CI) Unadjusted**	**P-Value**	**Odds Ratio (95% CI) Adjusted***	**P-Valu**
Any Complications	41 (91.1)	35 (50.0)	10.3 (3.3, 31.7)	<.0001	6.5 (1.5, 27.8)	.012
Need for Revision Surgery	26 (57.8)	9 (12.9)	9.7 (3.8, 24.9)	<.0001	5.7 (1.6, 20.4)	.008

*Adjusted for 2-stage surgery system.

Table 4.
Most Common Postoperative Complications by Procedure

Connect (% of complications)	**Attract (% of complications)**
1. Infection (40.0)	1. Device failure (lost parts, audio feedback) (27.1)
2. Device failure (loose screws/abutment) (18.5)	2. Pain/headache (25.4)
3. Bleeding/drainage (11.5)	3. Skin irritation (23.7)
4. Skin overgrowth (10.8)	4. Bleeding/drainage (11.9)

TABLE 5.
Parent Questionnaire Responses

	Connect (n = 31)	**Attract (n = 30)**	**P-Value**
Overall satisfaction, No. (%)			.173
Dissatisfied	4 (13.3)	4 (13.3)	
Neutral	6 (20.0)	1 (3.3)	
Satisfied	20 (66.7)	25 (83.4)	
Overall improvement in quality of life, No. (%)			.533
No to minimal improvement	2 (6.9)	5 (17.2)	
Moderately improved	3 (10.3)	3 (10.3)	
Much to very much improved	24 (82.8)	21 (72.4)	
Overall improvement in hearing loss, No. (%)			.048
No to minimal improvement	1 (3.3)	7(24.1)	
Moderately improved	2 (6.7)	3 (10.3)	
Much to very much improved	27 (90)	19 (65.5)	
Overall improvement in speech and language, (No. (%)			.035
No to minimal improvement	2 (6.9)	9 (33.3)	
Moderately improved	7 (24.1)	3 (11.1)	
Much to very much improved	20 (69.0)	15 (55.6)	
Overall improvement in school performance, (No. (%)			.782
No to minimal improvement	4 (13.8)	6 (22.2)	
Moderately improved	4 (13.8)	4 (14.8)	
Much to very much improved	21 (72.4)	17 (63.0)	
Willingness to recommend surgery to others, No. (%)			.679
Not to minimally willing	5 (16.1)	3 (10.7)	
Moderately willing	4 (12.9)	2 (7.1)	
Much to very much willing	22 (71.0)	23 (82.2)	
Usage, No. (%)			.901
Nonuser	6 (20.1)	6 (20.0)	
Minimal user (<2 hours/day)	3 (10.3)	3 (10.0)	
Partial user (2-6 hours/day)	6 (20.1)	4 (13.3)	
User (>6 hours/day)	14 (48.3)	17 (56.7)	

TABLE 6.
Demographics by Complication Status

	Complications	**No Complications**	**P-Value**
Sex, No. (%)			.240
Male (n=65)	40 (61.5)	25 (38.5)	
Female (n=50)	36 (72.0))	14 (28.0)	
Ethnicity, No. (%)			.770
Non-Hispanic or Latino (n=63)	42 (66.7)	21 (33.3)	
Hispanic of Latino (n=48)	32 (66.7)	16 (33.3)	
Unknown (n=4)	2 (50.0)	2 (50.0)	
Race, No. (%)			.934
Asian (n=8)	6 (75.0)	2 (25.0)	
Black (n=4)	3 (75.0)	1 (25.0)	
Native American (n=3)	2 (66.7)	1 (33.3)	
White (n=56)	38 (67.9)	18 (32.1)	
Other (n=44)	27 (61.4)	17 (38.6)	
Surgery ear, No. (%)			.711
Unilateral (n=83)	53 (69.7)	30 (76.9)	
Bilateral (n=32)	23 (30.3)	9 (23.1)	
Age (years) at time of implantation			.487
Mean (Std)	9.0 (4.2)	(8.4 (3.6)	

Connect vs Attract

Conclusions

- Recipients of Baha® Attract device implantation experience a much lower rate of complications and revision surgeries than Baha® Connect.
- Connect patients experience improved hearing, speech, and language outcomes.
- These differences did not translate into an obvious difference in reported parent satisfaction between groups, parents continue to report overwhelming improvement across all areas for both groups.
- Given similar quality of life outcomes, utilizing transcutaneous devices such as the Baha® Attract when appropriate may help reduce healthcare utilization and costs in pediatric patients.

References

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