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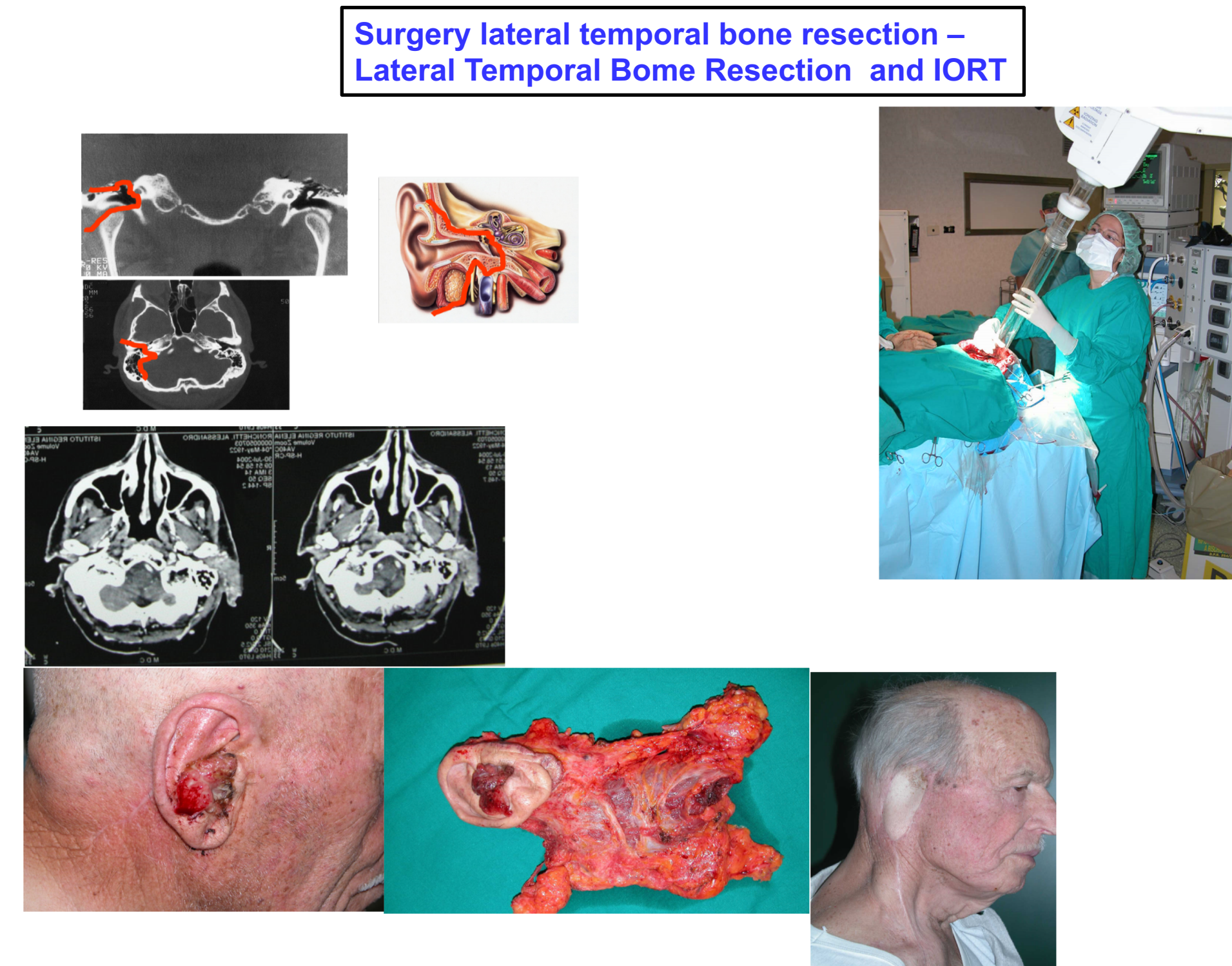
The incidence for squamous cell carcinoma of the external auditory canal, middle ear, mastoid and temporal bone is estimated to be 1-6/1,000,000 population. Complete surgical resection and radiotherapy are considered the gold standard treatment for these patients . IORT (Intra Operative Radiotherapy) has emerged as a feasible treatment modality for patients with advanced head and neck cancer, although the effectiveness of IORT in ear malignancy has never been investigated.

Material/Methods

Data on 13 consecutive patients affected squamous cell carcinoma (SCC) of ear canal . Median follow-up was 33 months (range 10-133). Eight patients (62%) had a primary tumour and 5 (38%) had a recurrence. Patients were stage III in 5 (38%) cases and stage IV in 8 (62%) cases according to the University of Pittsburgh TNM staging system proposed by Arriaga for temporal bone tumours. Table 1 shows demographic and characteristics of patients. Lateral temporal bone resection (LTBR) was used to treat the primary tumour in all cases. The facial nerve was sacrificed in 9 (69%) cases. The skin and soft tissues defect were reconstructed by myocutaneous pectoralis major flap in 10 (77%) cases. IORT was delivered after surgery Irradiation was performed with a dedicated mobile accelerator, NOVAC7 (Hitesys spa, now SIT spa, Latina, Italy), located in the operating theatre. The IORT dose delivered was 12 Gy in all patients calculated at 90% isodose. Hearing tests were conducted at baseline (before treatment) and at every follow-up after completing radiotherapy. Bone conduction thresholds were used to establish the changes in hearing frequencies. Each test consisted of pure-tone audiometry using bone conduction test on 0.5 KHz, 1 KHz, 2 KHz, 4 KHz, 6 KHz masking the contralateral ear using an Amplaid 309 audiometer (Amplifon, Italy). The baseline threshold level (bTL) of the treated ear was compared to the hearing threshold level after treatment (ptTL). Contralateral hearing was tested to assess the difference between the two sides.

Table I.								
Pts.	Age	Gender	Histology	Grading	TNM by Arriaga ^a	Stage by Arriaga ^a	Surgery	IORT dose (Gy)
1	73	m	SCC	2	T3 N2b	IV	LSTP + P + ND	12
2	86	f	SCC	3	T3 N2b	IV	LSTP + ND	12
3	64	f	SCC	2	T3 N0	III	LSTP + P + ND	12
4	60	m	SCC	3	T3 N2b	IV	LSTP + ND	12
5	68	m	SCC	3	T3 N0	III	LSTP + P	12
6	67	m	SCC	2	T3 N2b	IV	LSTP + P + ND	12
7	73	f	SCC	2	T4 N0	IV	LSTP	12
8	91	f	SCC	2	T3 N0	III	LSTP	12
9	56	m	SCC	2	T4 N0	IV	LSTP + P	12
10	82	m	SCC	2	T4 N2b	IV	LSTP + P + ND	12
11	64	m	SCC	2	T3 N0	III	LSTP + P	12
12	72	m	SCC	3	T3 N0	III	LSTP + P	12
13	47	m	SCC	2	T3 N2b	IV	LSTP + P	12

m: male; f: female; SCC: squamous cell carcinoma; LSTP: lateral subtotal petrosectomy; P: parotidectomy; ND: neck dissection.



Conclusions

A dose of 12 Gy of IORT on the inner ear and surrounding tissues during advanced ear cancer surgery can be considered as safe. Early complications were not observed, while late complications such as mild neurosensorial hearing loss on middle-high frequencies can be expected after IORT followed by IMRT. Future studies are required to assess the oncologic value of IORT in local control of disease, confirming the hypothesis of this retrospective study.

Results

Hearing tests Differences in neurosensory hearing before and after treatment was significant at all tested frequencies (p<0.05) except 0.5 KHz in the ear affected by tumour. Differences in neurosensory hearing before and after treatment in the contralateral ear were not significant. Figure 2 shows mean bone conduction before and after treatment in the ear affected by tumour. Figure 3 shows median values of bone conduction before and after treatment at all tested frequencies in both ears. Complications There were no intraoperative or postoperative deaths. The only early complication consisted in partial necrosis of the flap in 3 (23%) patients. Complete healing was achieved after dressing was applied in all cases. Meningeal fistula was the only late complication at 4 months after radiotherapy in a single (7.6%) previously untreated patient. CT showed local recurrence with fistula in this case. no other early or late complications were reported.

Disease control and survival one patient had a recurrence on the tumour bed at 6 months after surgery, while three patients had regional recurrence after 7, 8 and 11 months. lung metastases were observed in one case after 9 months of treatment. The 5-year IC rate was 68%. The 5-year DM rate was 90%. The 5-year DFS rate was 61%. The 5-year OS rate was for 69%.

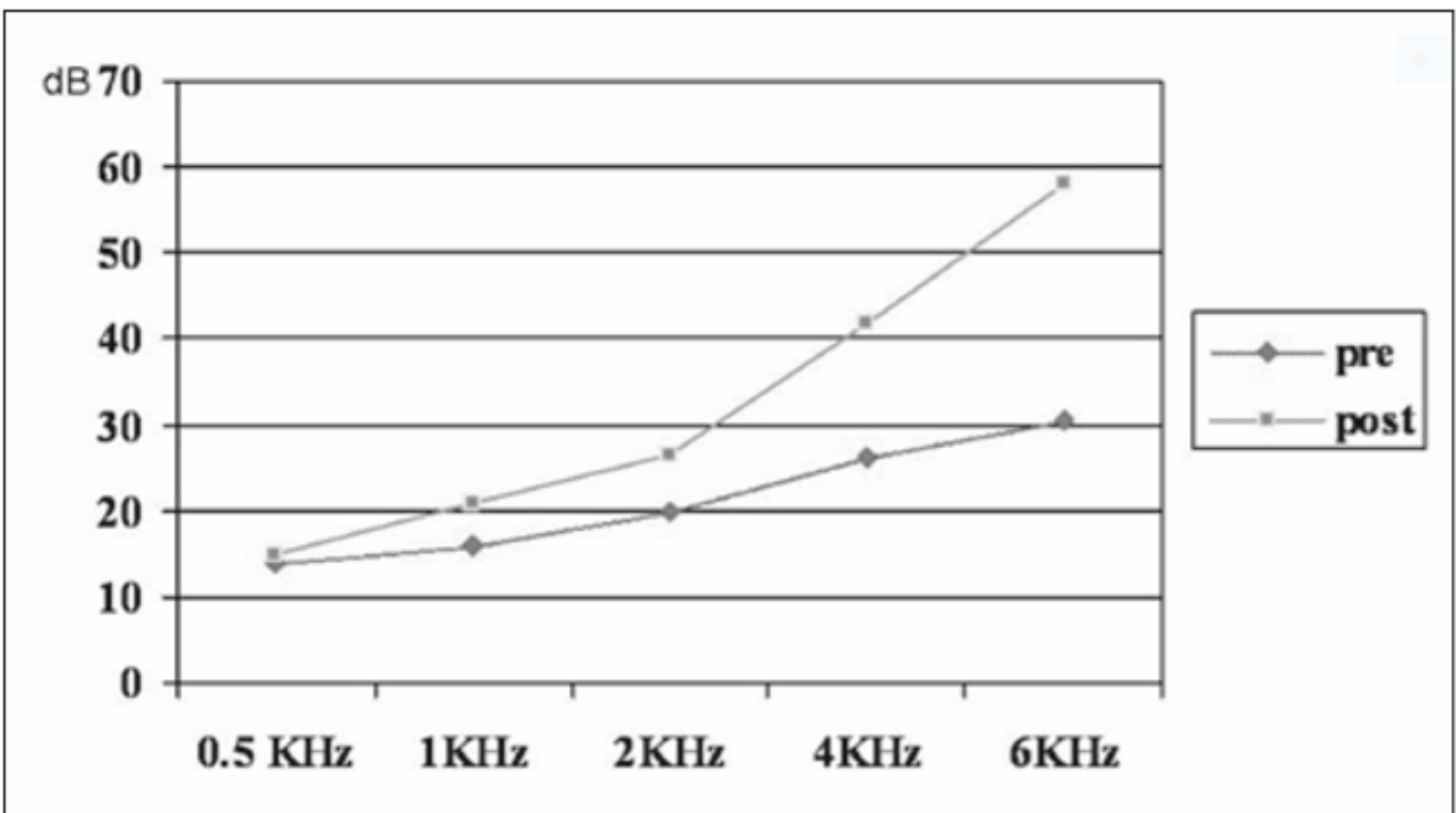


Fig. 2. Bone conduction in the affected ear. Mean bone conduction (decibels) before and after treatment of the affected ear.

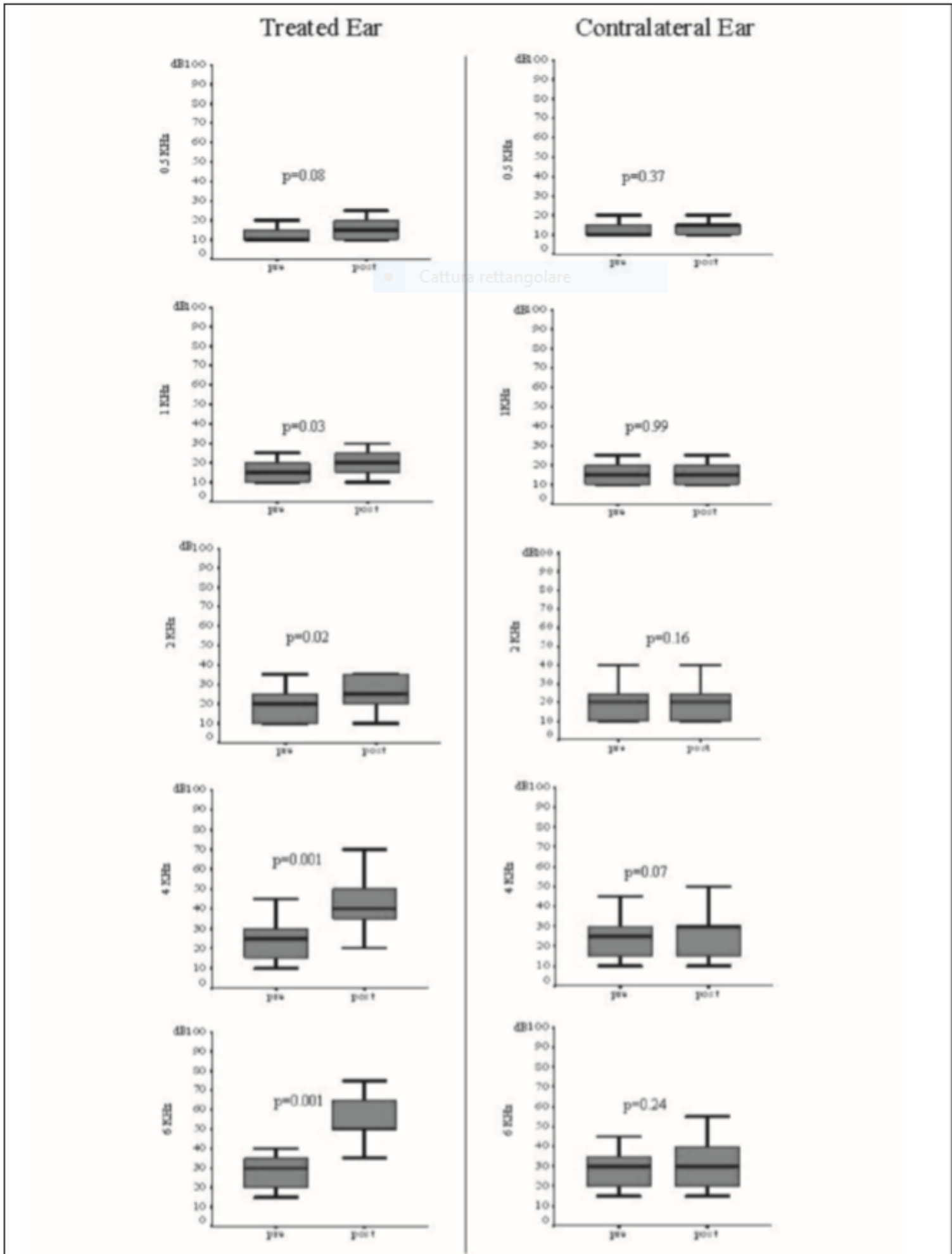


Fig. 3. Bone conduction in both ears. Median values of bone conduction before and after treatment at 0.5 KHz, 1 KHz, 2 KHz, 4 KHz and 6 KHz in the affected ear (left side) and the contralateral ear (right side).

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