

TINNITUS versus HEARING LOSS

Stan Styliis FRCS

This article demonstrates that (except in obvious medical conditions) the **common assumption that tinnitus is directly related to hearing loss is quite erroneous**. An analysis of **71** long haul flight attendants is quite compelling on this issue. This analysis is not to be regarded or looked at from the point of view of industrial deafness. Its findings are intended to throw light on tinnitus and its causation. A further article expanding the analysis and applying it to the general population will follow.

Seventy two long haul flight attendants taking up a retiring plan were examined with respect to their hearing. Each had a long history of employment in the industry, most between twenty and thirty years in the great majority; only five of the seventy two had a shorter history, being of fourteen to twenty years employment.

The parameters recorded were Sex, Age, Years of Service, the presence of Dental Malocclusion or Temporomandibular Joint dysfunction, the presence of Tinnitus, the presence of Exostoses in the ear canal and the presence of a compensable Binaural Hearing Impairment (greater than 6%) (**see *footnote*).

TABLE 1

The 71 cases are distributed as follows:-

Age group	Total No. of Cases	Number of Women in each age group
40 to 49	6	4
50 to 59	48	4
60 plus	17	1
Total	71	9 Women

62 Males

The following analysis and line of thought is necessary to explain the logic in the conclusions. This involves some repetition in the logical explanation of the different parameters being discussed.

* There were 6 cases (of the total 71) who had some minor hearing loss but this was less than 6% binaural hearing loss (as calculated on the on the Tables provided by the National Acoustic Laboratories Australia), **hardly a significant hearing loss** and who didn't qualify for Workers Compensation. These 6 cases were regarded as not having any significant hearing impairment in the tables. 4 of them had a BHI much of less than 3.1%, 1 had 3.9% and the other had 5.3% and no complaint of hearing loss. **All had DP**; 3 had Tinnitus.

Abbreviations used:

HL = Hearing Loss in general; could include any degree of hearing impairment and CID
CID = Compensable Industrial Deafness (6% or more Binaural Hearing impairment)
MO = Dental Malocclusion;
TMJ = Symptoms and signs of Temporomandibular Joint disorder + MO
DP = Dental Problems - The presence of MO or TMJ or both.
T1. = Refers to TABLE 1. etc.
TIN = Tinnitus (unrelated to any other obvious medical cause)

TABLE 2

Out of these 71 cases the following summary information was noted:-

	Dental Problems	Tinnitus	Exostoses	Compensation Claim (i.e. HL)
Actual number	51	30	11	14
Percentage affected	72%	42%	15%	20%

***Dental Problems (DP)** was used to indicate the presence of malocclusion and/or TMJ disorders.

Dental Malocclusion was recorded when the upper teeth did not occlude normally or “comfortably” with the lower teeth, particularly in the molar areas. Included were cases with a gross overbite, where there were numerous molars missing, where the molars did not actually meet on full occlusion but left a gap of a millimetre or so, where it was obvious that the worker chewed almost exclusively on one side, as the other side was deficient due to missing teeth or distortions so they did not meet properly, or there were other factors like crossbite and prognathism.

Temporomandibular joint dysfunction was diagnosed by excessive or irregular movement of the temporomandibular joint often with pain on palpation or exhibiting crepitus.

TABLE 3

Cases in each age group with compensable industrial deafness (HL) :-

Age group	Total No. of Workers in this Age group	Number of cases with HL in each Age group	Percentage with HL in each Age Group
40 to 49	6	0	(0%)
50 to 59	48	9	9/48 (19%)
60 plus	17	5	5/17 (29%)
TOTAL	71	14	

14 cases (1 in 5), **20 %** of the 71 workers had compensable industrial hearing loss (HL). (see footnotes on bottom of p.1)

Also the older the worker (also meaning the longer the service and exposure), the higher the incidence (percentage) of HL became evident as expected.

***Important Note**

The incidence of dental problems is certain to have been underestimated as it was based on findings of the TMJ and dental malocclusion which were **grossly obvious**. There is no doubt that there would also be minor anomalies recognisable only by the dental graduate; this would make the proportion of those with dental problems greater with respect to the considerations in this article. This would even further support the final conclusions.

A diversion here analysing the parameters found in women attendants serves to introduce the reader to the final conclusion.

THE WOMEN - The table below reveals some interesting aspects.

There were 9 women in the study:-

4 between the ages of 40 and 49

4 between the ages of 50 and 60

1 at 60.

TABLE 4 – Women Cases

INDENT. No	Age	Years of service	H/L	Tinnitus	TMJ	DM
4	40	17	No	Y	Y	Y
11	41	14	No	No	Y	Y
20	51	26	No	Y	Y	Y
26	41	12	YES	Y	Y	Y
30	60	16	No	Y	Y	Y
31	54	29	No	Y	*	Y
37	50	28	No	Y	*	Y
45	46	20	No	Y	Y	Y
53	58	27	No	Y	Y	Y

**not clearly noted in my clinical notes*

What does this Table tell you?

- All had **DP**.
- All (but one) had **tinnitus**.
- All (but one) had **NO H/L**

Therefore tinnitus and hearing loss do not go hand in hand – not by a long way. DP is very common, keeping in mind that hearing loss can occur in those with DP the same as in anybody else.

Only 1 woman out of the 9 had a hearing loss. That is of 9 women, the hearing loss occurred in 10%. Of the 62 men in the study (71 – 9 = 62), 13 had a hearing loss which is equivalent to ($\frac{13}{62}$) 21% of the men. This is not considered to be statistically significant nor of relevance.

But, 7 out of the 8 women **without a hearing loss** had **tinnitus** and **all had dental problems**. The 1 woman who had a hearing loss also had tinnitus, and in addition had dental problems. It appears that 8 out of 9 women had tinnitus, and all of them had dental malocclusion / TMJ problems.

So even thus far we can say definitely that **tinnitus, in the main, is not related to hearing loss.**

This is a significant revelation in the consideration of the cause and management of tinnitus and also in the assessment of tinnitus in industrial deafness.

In order to present the figures in an absolutely open manner, I present Table 5. I believe Table 5 cannot be accepted as completely valid in that, primarily the numbers are too small, and also there would be many cases of dental malocclusion which would only be able to be diagnosed by a trained Dentist. The ones described here are those whose dental problems are so prominent that they are obvious to everyone. However I present these figures.

TABLE 5 – Cases with Hearing Loss

In considering those with tinnitus and those without tinnitus in the 14 cases with HL (20% of the 71 workers) the following characteristics existed:- (DP = Dental Problem)

		MO	TMJ	With DP	No DP
With tinnitus	9 (64%)	3	2	5	4
No tinnitus	5 (36%)	2	0	2	3
TOTAL	14 (with HL)			= 7 (50%)	7 (50%)

But of 7 workers with HL and **with DP**, 71% ($\frac{5}{7}$) **had tinnitus**; 29% ($\frac{2}{7}$) did not.

No statistically significant deductions can be made from this table 5; it is presented for general interest only. The parameters are the subject of further studies.

The purpose of this study is to show that DP are a major contributor to the causation of Tinnitus.

TABLE 6 – Cases with DP regardless of the hearing status:

	MO alone	MO + TMJ Both	Total DP = MO with and without TMJ
a. Of 71 workers examined (100%) and of these:-	12 (17%)	39 (55%)	51 (72%)
b. 30 of the 71 workers had tinnitus and were grouped thus ($\frac{30}{71} = 42\%$) and of these:-	3 (10%); [$\frac{3}{30}$]	23 (76%); [$\frac{23}{30}$]	26 (87%); [$\frac{26}{30}$] 13% did not have DP

What does this tell us?

- Of all 71 cases 72% had DP

- In tinnitus 87% have **DP**
- In HL + DP 71% have **tinnitus** (Table 5 #)

ANALYSIS : 71 cases in total

A. Dental Problems:

51 ($^{51}/_{71} = 72\%$) had **DP**

- Of these 51 cases
 - 7 ($^7/_{51} = 14\%$) had hearing loss
 - 44 ($^{44}/_{51} = 86\%$) had **NO hearing loss** **

 - 24 ($^{24}/_{51} = 47\%$) had **NO** tinnitus
 - 27 ($^{27}/_{51} = 53\%$) had **tinnitus** **

B. Hearing Loss: *Not statistically significant symptoms because a small no. of cases*

14 cases ($^{14}/_{71} = 20\%$) had **hearing loss**

- Of these 14 cases
 - 7 ($^7/_{14} = 50\%$) had DP
 - 7 ($^7/_{14} = 50\%$) had **NO** DP

 - 9 ($^9/_{14} = 64\%$) had tinnitus
 - 5 ($^5/_{14} = 36\%$) had **NO tinnitus** **

57 cases (71 – 14) ($^{57}/_{72} = 80\%$) had **NO hearing loss**

Of these 57 cases

- 21 ($^{21}/_{57} = 37\%$) had **tinnitus** **
[**All** of these 21 had DP (100%)]
 - 36 ($^{36}/_{57} = 63\%$) had **NO** tinnitus
-

Of the 57 with **NO** hearing loss, **35** cases **also** had **NO** tinnitus

- 22 ($^{22}/_{35} = 63\%$) had DP
- 13 ($^{13}/_{35} = 37\%$) had **NO** DP

C. Tinnitus:

30 ($^{30}/_{72} = 42\%$) had **tinnitus** (as in B above (9+21=30) & Table 2, p.2)

- Of these 30 cases
 - 26 ($^{26}/_{30} = 87\%$) had **DP** **
 - 4 ($^4/_{30} = 13\%$) had **NO** DP

- 9 ($9/30 = 30\%$) had HL
- 21 ($21/30 = 70\%$) had NO HL **

D. Combination of Parameters (from the data table)

Of 35 cases who had **NO** hearing loss **AND NO** tinnitus

- 22 ($22/35 = 63\%$) had DP
- 13 ($13/35 = 37\%$) had **NO** DP (see Analysis B.)

Of 26 cases who had DP **AND** tinnitus

- 21 ($21/29 = 81\%$) had **NO** hearing loss **
- 5 ($5/26 = 19\%$) had hearing loss

Of 11 cases with **NO** hearing loss AND **NO** DP

- **NONE** had Tinnitus

SUMMARY : A selection of key figures -

Of 71 cases -

51 (72%) had **DP** (see Analysis A.)

- 27 ($27/51$) **53%** had Tinnitus*
- 44 ($44/51$) **86%** had **NO** Hearing Loss

14 (20%) had **Hearing Loss** (see Table 5)

- Of 7 with **DP** + HL, 5 ($5/7 = 71\%$) had Tinnitus **
- (Of 7 with **NO** DP + HL, 4 ($4/7 = 57\%$) had Tinnitus)

30 (42%) had **Tinnitus** (see Analysis C.)

- 26 cases ($26/30 = 87\%$) had **DP** * **XXXX**
- 9 cases ($9/30 = 30\%$) had HL*
- 21 cases ($21/30 = 70\%$) had **NO HL*** **XXXX**

26 cases had **DP + Tinnitus** (see Analysis D.)

- 21 (**81%**) had **NO Hearing Loss** **XXXX**

CONCLUSIONS:

1. **87% of those who had tinnitus had DP.** Note that the real incidence of dental malocclusion may well be underestimated in this study, therefore the conclusions are likely to be even more impressive than the following. (see *footnote on Page 2)
2. **BUT, only 30% of those with tinnitus had hearing loss.**
i.e. **70% of those with tinnitus DID NOT have hearing loss. XXXXXX**

3. **53% of cases with DP have Tinnitus.** ie. if one has DP it is not always accompanied by tinnitus, but at least 50% do have tinnitus (and only one in four of these have a hearing loss).
4. So dental problems are associated with tinnitus. No one would consider that tinnitus could cause dental problems.
5. Hearing loss may contribute to the presence of tinnitus in a proportion of cases but this is subject of a further study. It is very important to note that the number of cases (14) who had hearing loss was very small and therefore not statistically significant the incidence of Tinnitus (of 64%) may well be misleading. As DP is so common, a high presence of hearing loss may be purely by chance. Thus further studies are being conducted in the dental field and will also be required in the general population.

Taking the above in conjunction with the analysis of the 9 women cases as seen on page 3, there appears to be very little doubt that the relationship between tinnitus and dental problems (in the form of dental malocclusion or temporomandibular joint disorder) is in excess, or at the least equal, of any relationship between tinnitus and hearing loss.

That 70% of cases with tinnitus did not have a hearing loss , and 87% of cases with tinnitus had Dental problems is very compelling.

THE KEY CONCLUSION:

The overall evidence above indicates that dental conditions as specified are a major contributor to the causation of tinnitus. That is, tinnitus appears to be related more to the presence of dental problems than it is to hearing impairment.
