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Original Article

The occlusal imaging and analysis system by T-scan III in tinnitus patients

Federica Di Berardino [a,*], *Eliana Filipponi* [b], *Massimo Schiappadori* [a], *Stella Forti* [a], *Diego Zanetti* [a], *Antonio Cesarani* [a]

[a] *Department of Clinical Sciences and Community, Audiology Unit, IRCCS Fondazione Policlinico, Mangiagalli e Regina Elena, University of Milan, Milan, Italy*

[b] *S.I.T.R.A. Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy*

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ABSTRACT

Background: Several studies have demonstrated that the prevalence of temporomandibular disorders (TMDs) in tinnitus patients ranges from 7% to 95%, and it is reported in literature that idiopathic tinnitus patients should be referred to a dentist to define whether or not the tinnitus is associated with TMD. However, the possible pathophysiological relation between TMDs and tinnitus is not generally investigated in clinical practice.

Methods: The patterns and forces of occlusal contacts have been studied by means of T-scan III in 47 tinnitus patients (23 suffering from idiopathic tinnitus and 24 affected by Ménière disease [MD]) and 13 healthy subjects.

Results: The center of force target was offset in the opposite direction in 15/23 idiopathic tinnitus and in 7/24 MD patients ($p = 0.026$). No significant variation was found in the occlusal force.

Conclusions: Our data suggest that a diagnostic screening method for occlusal stability in the intercuspidal position might be clinically useful in idiopathic tinnitus patients.

* *Corresponding author*. Department of Clinical Sciences and Community Health (DISCCO), Audiology Unit, IRCCS Fondazione Policlinico, Mangiagalli e Regina Elena, University of Milan, Via Pace 9, Milan 20122, Italy. Tel.: +39 02 55033922; fax: +39 02 50320756.
E-mail address: federica.diberardino@unimi.it (F. Di Berardino).

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At a glance commentary

Scientific background on the subject

A disharmony of the occlusal contacts in the intercuspal position (ICP) is an important etiologic factor in temporomandibular disease that might be underwhelmed during the standard otological evaluation of tinnitus patients.

What this study adds to the field

The study of occlusal stability using the T-scan III system seems to be a valuable additional tool in the clinical evaluation of tinnitus patients. In particular, this diagnostic screening method was able to discriminate a typical (COT) distribution in idiopathic tinnitus patients.

Tinnitus is a subjective auditory perception; although it is really perceived by patients, it cannot be measured objectively. Several theories have been proposed to explain the mechanisms underlying tinnitus involving central and peripheral generators located in the auditory pathway [1]. In particular, a hyperactivation of the dorsal cochlear nucleus mediated by the somatosensory system, among which the temporomandibular region, has been related with tinnitus symptom [2].

From the clinical practice, it is well-known that tinnitus may be influenced by disorders of the masticatory system [3]. Several studies have demonstrated that the prevalence of temporomandibular disorders (TMD) in tinnitus patients ranges from 7% to 95%. Indeed, the high prevalence of signs and symptoms of TMD in tinnitus patients reported by Levine et al. [4,5] and the pathophysiological connection between the two conditions seem to support a somatosensory origin in some tinnitus cases [6]. For this reason, in addition to the standard neuro-otologic examination, the inspection of the teeth has been proposed as an integral part of the audiologic examination in patients with tinnitus together with palpation of the craniocervical musculature for trigger points, and probing whether the tinnitus percept can be modulated with somatic testing [7].

In 2011, Pihut et al. first published that both structural and functional disorders of the stomatognathic system are associated with unspecific auricular–vestibular symptoms more frequently than expected [8]. Furthermore, a recent publication has shown that patients with TMD have 3.22-fold significantly higher relative risk of developing tinnitus within 3 years of follow-up [9].

Therefore, regarding tinnitus, there is evidence in literature that, if a clinical diagnosis of TMD is supported by history, symptoms, and clinical evidence, the patient should be referred in a timely manner to a dentist who is competent to manage the patient [10,11]. Furthermore, a coordinated treatment of temporomandibular and cervical spine disorders in patients with Meniere's disease (MD) has been proved to be an effective therapy for the relief from the typical symptoms of this disease, which are dizziness as episodic spinning or whirling vertigo, fluctuating low-frequency sensorineural hearing loss, tinnitus, and a sensation of fullness in the ear [12].

However, the TMD disorder may be subclinical [13] or may involve only a mandibular motor problem rather than a joint problem. Therefore, these patients, complaining of evident otological symptoms, are more likely to seek advice from an Otolaryngologist than a Dentist/Orthodontist [8].

The T-scan III occlusal imaging and analysis system could prove clinically useful as a diagnostic screening method for occlusal stability in the intercuspal position (ICP) [14,15]. A disharmony of the occlusal contacts in the ICP is, in fact, an important etiologic factor in TMD [16] that might not be detected, during the standard otological evaluation.

We, therefore, decided to investigate the patterns and forces of occlusal contacts with the T-scan III occlusal imaging and analysis system in patients affected by tinnitus to perform an objective analysis of the occlusal balance in the ICP and to try to correlate it with the otological disturbance.

Materials and methods

We studied the occlusal contacts in the ICP in 23 patients affected by idiopathic tinnitus (mean age 50.9 ± 17.12 years; 12 females, 11 males), and in 24 patients affected by MD (mean age 58.0 ± 14.5 years; 16 females, 8 males).
The inclusion criteria comprised:

- Willingness to participate
- A subjective, idiopathic, troublesome, unilateral, non-pulsatile tinnitus of more than 6 months' duration.

The exclusion criteria comprised:

- External, middle, or internal acute or chronic ear pathologies such as tympanosclerosis, otosclerosis, and noise-induced hearing loss and definite MD for the first group
- Retrocochlear lesions
- Other known anatomic/structural lesions of the ear
- Temporal bone or head trauma
- Active alcohol and/or drug dependence, or history of alcohol and/or drug dependence within the last year
- Psychological illness such as major depressive disorder; subjects taking over-the-counter, or prescribed medication administered for the treatment of any psychiatric, or neurologic disorder, or any other known central nervous system active drugs, including herbal, over-the-counter, and homeopathic medications
- Coexistence of systemic diseases causing tinnitus
- Objective tinnitus
- Hyperacusis
- Dental problems or known TMD
- Neck complaints (in particular, no whiplash injury)
- A positive history for vestibular complaints or dizziness in the idiopathic tinnitus group.

In addition, 13 normal-hearing subjects without tinnitus were recruited (mean age 34.7 ± 16.2 years; 11 females, 2 males) as controls.