

INTERACTIVE METADISOURSE IN DENTISTRY RESEARCH ARTICLES: IRANIAN VS NON-IRANIAN ACADEMIC WRITERS

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Abstract

Linguistically, interactive metadiscourse devices are responsible for creating an unfolding and persuasive piece of writing. They help writers come up with a cohesive and reader-friendly text and highlight how they control the interactive meaning. This corpus-driven study is an attempt to explore the use of interactive metadiscourse markers in English dentistry research articles published in International ISI-indexed and Iranian local research-based journals. The aim was to see if interactive resources, as realized by rhetorical options, such as transitions, code glosses, endophoric markers, evidentials, and frame markers, are predisposed to discipline-specific rhetorical conventions. To this end, forty dentistry research articles were analyzed using Hyland's (2005) Interpersonal Model of Metadiscourse. The results disclosed similarities and differences in both the frequency and use of interactive resources between the two sets of research articles. The present results are expected to extend our understanding of authorial preferences for the use of metadiscourse markers in tandem with discourse functions in research articles in the selected discipline. The results of such studies may also improve different features of language pedagogy, such as teaching and learning academic writing, namely research articles.

Keywords

research articles, rhetorical variations, linguistic features, interactive metadiscourse markers, discourse functions

1 Introduction

Regardless of culture, language, and the disciplinary community, academics are expected to contribute their knowledge and new findings through communicative academic genres, including the research article (hereafter RA). As opined by Abdollahzadeh (2011), effective writing needs writers to equip themselves with the knowledge of community-oriented employment of the proper linguistic features to produce a cohesive and reader-friendly text. Among the features is metadiscourse. The basis of metadiscourse is the view of writing as a socially engaging act. Metadiscourse highlights how writers control the interactive meaning, and at the same time, express their commitments and perspectives. Research has shown that the appropriate deployment of metadiscourse in text

is an indispensable part of constructing a cohesive and persuasive discourse (cf. Intaraprawat & Steffensen 1995). Writers' unfamiliarity with preset rhetorical norms in a particular community leads to improper employment of textual and interpersonal linguistic features. The outcome is a substandard text in which the ideational meanings are not effectively interpreted, thus not proper for publication.

The term metadiscourse was first introduced by Zellig Harris in 1959 (as quoted in Hyland 2005: 3) to offer a method for "understanding language in use, representing the writer or speaker's attempt to guide a receiver's perception of a text". Drawing on Hallidayan meta-functions of language (Halliday 1973), some scholars refer to metadiscourse as 'discourse about discourse', 'writing about writing', or 'communication about communication' (cf. Williams 1981, Vande Kopple 1985, Crismore et al. 1993, Mauranen 1993a). They view metadiscourse as linguistic elements that add nothing to propositional content, but that signal an author's intrusion into the discourse, either explicitly or non-explicitly, to direct rather than inform, guiding the reader or listener to organise, interpret, and evaluate what is said and meant in the primary discourse and how to 'take' the author or speaker.

However, Hyland and Tse (2004) believe that metadiscourse is not just the 'glue' that puts the more essential segments of the discourse together. Instead, it is an integral feature of the discourse that has rhetorical and pragmatic functions at its disposal, and that facilitates setting out arguments and recovering the writer's preferred interpretations and goals. They argue that all metadiscourse is interpersonal "in that it takes account of the reader's knowledge, textual experiences and processing needs and that it provides writers with an armoury of rhetorical appeals to achieve this" (ibid.: 41). Therefore, Hyland and Tse (2004) and Hyland (2005) depart from the Hallidayan duality of textual and interpersonal properties of discourse and adopt Thompson and Thetela's (1995) and Thompson's (2001: 61) description of interactive and interactional resources, which are regarded as "two sides of the same coin". Accordingly, Hyland and Tse (2004) and Hyland (2005: 37) contribute their pragmatically developed model, which views metadiscourse as "reflective expressions used to negotiate interactional meanings in a text, assisting the writer (or speaker) to express a viewpoint and engage with readers as members of a particular community". The model divides metadiscourse into the two broad categories of interactive and interactional resources. Interactive metadiscourse "primarily involves the management of information flow" (Hyland 2005: 44) that, by anticipating the likely needs and reactions of the target audience, leads them to the writer's intended goals and interpretations. Interactional metadiscourse, by contrast, is

“more personal” (ibid.) and alludes to the authorial epistemic stance on ideational material and their attitude towards readers to involve them in the mutual creation of the discourse. Included here are rhetorical options that are “evaluative and engaging”, “expressing solidarity”, “anticipating objections”, and “responding to an imagined dialogue with others” (ibid.: 49-50).

Metadiscourse has been studied across different genres (Hyland 2002, 2003) as well as within and between disciplines from both the soft and hard ends of the academic continuum (e.g. Harwood 2005, Hyland 2005, Khedri et al. 2013, Cao & Hu 2014, Salas 2015, Khedri 2016, McGrath 2016, Khedri & Kritsis 2018, 2020). Another important line of inquiry has been the cross-cultural and cross-linguistic study of metadiscourse markers (e.g. Vassileva 2000, Breivega et al. 2002, Dahl 2004, Fløttum et al. 2006, Yakhontova 2006, Mur-Dueñas 2007, Sheldon 2009, Molino 2010, Abdollahzadeh 2011, Hu & Cao 2011, Loi & Lim 2013), which have been found to vary across rhetorical cultures in terms of both their frequency and range of uses. Therefore, metadiscourse seems to be an important focus of analysis for the study of cultural orientations in academic writing, including RAs.

Although the two sets of interactive and interactional metadiscourse play an important role in successful academic communication, most previous studies have given a great deal of insight into the use of interactional features in RAs (e.g. Mur-Dueñas 2007, Gillaerts & Velde 2010, Abdollahzadeh 2011). In addition, with notable exceptions (e.g. Khedri et al. 2013, Cao & Hu 2014), the small number of investigations into interactive resources (e.g. Bunton 1999, Dahl 2004, Peterlin 2005, Hyland 2007, Murillo 2012, 2019, Guziurová 2020, Barabadi et al. 2021) typically scrutinized only a subset of interactive metadiscourse markers (henceforth IMMs) each time, which arguably made it difficult to identify common mechanisms shaping the use of interactive resources as a whole (cf. Cao & Hu 2014). The gap seems to be more critical when it comes to the use of IMMs in English RAs in specific fields, such as dentistry, published in international and local journals. Taking metadiscourse as the theoretical framework, this piece of research, then, aims at providing a comprehensive analysis of features realizing the interaction between writers and readers in a corpus of English dentistry RAs published in International ISI-indexed and Iranian local research-based journals. The study seeks to shed some light on the similarities and differences between Iranian and non-Iranian writers in using IMMs in their RAs. More specifically, the research questions to be addressed in this article are: (1) What are the similarities and differences in the use of IMMs between English dentistry RAs written by Iranian and non-Iranian scholars?; (2) Is there any statistically meaningful difference between Iranian and non-Iranian dentistry RA writers in

their use of IMMs?; (3) What use do Iranian scholars make of IMMs in English dentistry RAs in a national context within a particular disciplinary community?; and (4) What use do non-Iranian scholars make of IMMs in English dentistry RAs in an international context within the same disciplinary community?

2 Method

2.1 The corpus

The corpus of this study consisted of 40 English dentistry articles written by the two groups of Iranian and non-Iranian academic writers (20 per each group), totaling 113,840 words (see Table 1). The data size was justified by adopting a mixed-methods research approach embracing frequency and functional analyses of IMMs. The observations here were limited to the present dataset and no attempt was made to allow generalizations about the use and nature of IMMs in RA writing.

	Non-Iranian sub-corpus	Iranian sub-corpus
No. of RAs	20	20
No. of journals	2	3
Length of RAs (range of words)	1,829-5,102	1,400-3,826
Corpus size per context	66,312	47,528
Total corpus size	113,840	

Table 1: Data description

Regarding article selection, it was mainly done using a stratified random sampling method. The following external criteria (Biber 2004) were also preferred to ensure tertium comparationis, that is “a common platform of comparison or shared similarity between texts” (Connor 2004: 292). All the RAs selected were:

- a) full-length empirical research studies conforming to an Introduction, Method, Results and Discussion (IMRD) layout – a widely accepted conventional format proposed by Swales (1990); and
- b) published during the period 2011-2020.

The RAs were selected from a pool of representative International ISI-indexed and Iranian local research-based dentistry journals to increase the validity of the study. To select the journals to be taken within each context, a preliminary survey was run. First, two insider-specialists from the departments of dentistry at two highly ranked Iranian universities were recruited. They were then asked to independently provide examples of English-medium local and international journals of prestige in their field which they often read and/or target

for publication. Following their nominations, the articles written by non-Iranians were sourced from the internationally reputed journals of *Clinical Oral Implants Research* and *Clinical Implant Dentistry and Related Research* (Wiley Online Library). The two journals are indexed in the ISI Web of Science (2011) and have a high impact factor. The articles written by Iranian academic writers were taken from the leading local journals in the field of dentistry published in Iran. They were selected from *Journal of Dentistry* (Shiraz University Press), *Frontiers in Dentistry* (Tehran University of Medical Sciences Press), and *Journal of Dental Research, Dental Clinics, Dental Prospects* (Tabriz University of Medical Sciences Press). These local journals' policies for submission and acceptance are highly similar to the above international journals. They are research-based, quality journals ranked by the Ministry of Sciences, Research, and Technology of Iran. They have chief, associate/deputy editors and high rates of submission, and thus systematic and rigorous editorial policies. In general, the selected international and local journals are comparable in terms of the outsized discourse community in which they function, cover a large scope of topics within each discipline, and following Bazerman (1994: 131), are considered to have "expert performance" and be "situationally effective" in their message delivery.

As mentioned earlier, this corpus-driven study sets out to examine disciplinary rhetorical variation, not cultural variation in RAs written in English. Therefore, with reference to the international ISI-indexed journals and the authors who published in them, it must be acknowledged that they come from different cultural backgrounds. No attempt was made to choose native-speaker authors, which in any case cannot be identified by merely looking at their name or the name of the institution where they work. Consequently, the nationality of the scholars was not tracked nor considered in the analysis.

2.2 Analytical categories

Hyland's (2005) categorization of interactive resources was adopted and the five IMMs *transitions*, *code glosses*, *endophoric markers*, *evidentials*, and *frame markers* comprise the categories for analysis. These categories, albeit non-exhaustive, take account of the inclusive spectrum of metadiscoural features materialized by a variety of lexico-grammatical constructions. Each category is explained below accompanied by actual uses taken from the corpus at hand. Illustrations of the IMMs are in bold.

Transitions include conjunctions and adverbial phrases that encode ideational information on inferential procedures or processes, thus helping readers make pragmatic connections between different stages of the text. In this study, transitions were limited to inter-sentential devices since intra-sentential connectors like

because, although, and since are about “the outside world” (Hyland 2005: 50), thus serving syntactic roles (cf. Gardezi & Nesi 2009, Mur-Dueñas 2011, Cao & Hu 2014). Semantically, transitional markers could project additive (e.g. *and, moreover*), comparative (e.g. *likewise, however*) or consequential (e.g. *in conclusion, thus*) connections between ideas. Text examples are:

- (1a) *On the contrary, fixed prostheses in the maxilla are more successful than removable dentures.* [Int1]
- (1b) *Furthermore, these procedures are less time-consuming.* [Ir3]

Another central category refers to code glosses. According to Hyland (2005, 2007), they supply additional information, by elaborating, explaining, or rephrasing what has been mentioned, to reduce any potential communicative defects of a text, as well as to ensure the reader is able to recover the writer’s preferred meaning. Code glosses reflect the writer’s predictions about the reader’s knowledge base. Illustrations of code glosses are expressions, such as *that is, for example* or *simply put*. Alternatively, they are marked off by punctuation marks, such as parentheses and a comma. Some actual uses are as follows:

- (2a) *Today, although synthetic bone substitute materials **such as** hydroxyapatite (HA) or beta-tricalcium phosphate (b- TCP) have been [...].* [Int2]
- (2b) *The castings and abutments were immersed in ultrasonic cleaner containing cement removal agent (**Removal on-1, Premier Dental products Co, Norriston, PA**) for 30 and 15 minutes, respectively.* [Ir4]

Endophoric markers (e.g. *see Figure 3, as listed in Table X, as explained earlier*), also called ‘text references’ (Bunton 1999) or ‘locational metatext’ (Dahl 2004), refer to reflexive linguistic items deployed to draw attention to propositions presented elsewhere in the same text. These markers equip readers with extra propositional content to assist them to better grasp writers’ preferred meanings. Below are some text examples:

- (3a) *The objective of **this study** was to assess if the nonremoval of abutments placed at the time of the surgery ...* [Int7]
- (3b) *There were no statistically significant differences between groups 1 and 2 (**Table 3**).* [Ir6]

As regards evidentials, they refer to linguistic expressions that represent ideas taken from sources out of the text, thus enabling the writer to stress his/her own credibility. In other words, evidentials help writers build up the authorial

command of the subject and support their positioning. Expressions such as *X states that* and *according to* are illustrations of evidentials (Hyland 2005: 51-52). The following are examples from the corpus:

- (4a) *In our previous publications [...], the implant 10-year survival rate varied from [...].* [Int8]
- (4b) *The difference between the experimental and the control groups at the 7-day interval were significant, consistent with **the results of other studies**.* [Ir5]

The final category is frame markers. This type of IMMs, also known as ‘rhetorical metatext’ (Dahl 2004) or ‘organizational metadiscourse markers’ (Hempel & Degand 2008), refer to reflexive text language used to package the information and mark out text organization and boundaries through sequencing (e.g. *first, second, 1/2, a/b*), labeling (e.g. *to summarize, in sum*), announcing (e.g. *I argue here, this study aims to*), and shifting the direction of arguments (e.g. *regarding, with reference to, now*). Consider the following examples:

- (5a) **Overall**, the output torque of a surgical motor decreases gradually [...]. [Int10]
- (5b) *In light of the above, **the aim of this study was to** evaluate the influence of the mandible to find ...* [Ir7]

2.3 Data coding

Once the corpus was compiled, a search to identify IMMs in each sub-corpus was made using WordSmith Tools – a set of operative text analysis programs used to identify language features in electronically-saved texts (Scott 2004). We started by examining the tokens of IMMs in Hyland’s (2005) list. However, since interactive resources are an open-ended category of identification and may be compositionally complex, manual annotation was then taken to i) tease apart multifunctionality; ii) ensure that the computer-driven features were acting as metadiscourse and expressing discourse-internal relations; and iii) identify the writers’ discourse functions for using IMMs in each dataset.

In order to reduce the risk of randomness and demarcate the precision of the analytical approaches taken at an adequately high level of consensus, a consistent method to data coding was essential. Therefore, although the corpus was mainly analyzed by the researchers, it was decided to improve on the coding of the texts through inter-coder agreement. The RAs were first coded sentence by sentence and a sheet of analysis was appended to each one for systematic comparison. Then, a small subset of the corpus – ten RAs (five from each sub-corpus) – was independently analyzed by a PhD graduate whose area of specialism is

academic writing. He received several training sessions along with a coding manual containing descriptions and examples. Once the corpus was analyzed, the researchers went through the texts with the coder to identify any conflicting results. Slight conflicts in the identification of the writers' discursual functions of the use of IMMs were found and ironed out through discussion. Inter-coder reliability was measured using Cohen's kappa, with the resulting value of 0.89 signalling a strong level of agreement.

2.4 Data analysis

We conducted both quantitative and qualitative analyses of the IMMs identified in the corpus. For the quantitative analyses (using IBM-SPSS 27.0), different statistical tests depending on the normality distribution of raw frequencies were run on the data to see if any difference between the two groups of writers in their use of IMMs is statistically meaningful. To this end, the Shapiro-Wilks test was run to evaluate whether the results relating to each category and sub-categories of IMMs within each sub-corpus are normally distributed or not. Where the distribution was normal, the two sub-corpora were compared using the independent samples *t*-test. However, where the hypothesis of normality distribution was violated, the Mann-Whitney *U*-test, which is a non-parametric test, was conducted to evaluate the significance level of the difference observed between both sets of data. A chi-square statistical analysis was also performed to determine the significance of the difference found in the total frequencies of IMMs identified in the Iranian and non-Iranian sub-corpus. In the reporting of results in the next section statistical values are shown. The significance level was established at $<.05$ in all the types of statistical analyses used.

The qualitative analyses involved studying every instance of IMMs in context and examining how the various types of IMMs were used qualitatively similarly or differently across the corpus. To identify discourse functions, we began by analyzing the corpus guided, in part, by a compilation of the previously identified functions in other studies (cf. Khedri et al. 2013, Loi & Lim 2013). While reference was made to past studies, a data-driven approach was taken, with the functional analysis of the writers' uses of IMMs being derived from the corpus at hand. In the present study, cases of use found in at least one sub-corpus with at least one instance per 1,000 words¹ were regarded as main discourse functions.

3 Results and discussion

Table 2 illustrates the frequency of the use of IMMs in the two sub-corpora. The figures show that interactive devices are more frequent in the Iranian set of data than in the non-Iranian sub-corpus (53.9 vs 49.7 tokens per 1,000 words).

The chi-square statistical analysis run on IMMs as a group yielded a significant difference, $p = .001$, $\chi^2_{(4)} = 71.52$.

	Non-Iranian sub-corpus		Iranian sub-corpus		Test statistic value	P value
	Raw	Norm.	Raw	Norm.		
Transitions	880	13.2	726	15.2	$t_{(38)} = 1.53$	.135
Code glosses	820	12.3	458	9.6	$t_{(27.1)} = 3.73$	.001
Endophoric markers	522	7.8	394	8.2	$t_{(38)} = 21.65$	.037
Evidentials	730	11	764	16	$t_{(38)} = -0.39$	.696
Frame markers	344	5.1	224	4.7	$t_{(38)} = 4.29$	< .001
TOTAL	3,296	49.7	2,566	53.9	$\chi^2_{(4)} = 71.52$	< .001

Table 2: Frequency of use of IMMs in the two sub-corpora

A closer look at the table also reveals variations in the distribution of IMMs between the two sets of data. Transitions (13.2 instances per 1,000 words), followed immediately by code glosses (12.3 instances), are the most frequent categories in the non-Iranian dataset. In contrast, evidentials (16 tokens per 1,000 words) and transitions (15.2 tokens) were pervasive in the Iranian sub-corpus. While evidentials are placed in third position in the non-Iranian set of data (11 instances per 1,000 words), code-glosses occupy the same position in the Iranian sub-corpus (9.6 cases per 1,000 words). This is followed by endophoric markers as the fourth most frequently used category in the two sets of data. They were employed 394 times (8.2 per 1,000 words) by the Iranian writers and 522 times (7.8 per 1,000 words) by their non-Iranian counterparts. Finally, frame markers have the lowest frequency of use in both sub-corpora, totaling 344 cases (5.1 per 1,000 words) in the Iranian sub-corpus and 224 cases (4.7 per 1,000 words) in the non-Iranian dataset. The detailed status of each category and their discourse functions are discussed below.

3.1 Transitions

One of the basic features of academic writing is a high frequency of transitions, indicating the necessity of creating an internal cognitive link in the text. In this study, transitional markers made up 28.2 per cent and 26.6 per cent of the total IMMs identified in the Iranian and non-Iranian sub-corpus, respectively. The independent samples *t*-test on transitional markers as a group found a non-significant difference between the two sub-corpora, $p = .135$, $t_{(38)} = 1.53$ (see Table 2). However, a closer look at the figures illustrated in the table shows that transitions appeared more frequently in the Iranian sub-corpus

than that of the non-Iranian (15.2 vs 13.2 cases per 1,000 words). It can be argued that the texts created by Iranian writers are more reader-oriented, cohesive, and unfolding.

In the two sub-corpora, transitions were used by the writers to highlight a range of rhetorical functions, albeit to a different extent, realized by various linguistic resources performing different semantic functions of addition (*also, and, moreover, in addition, furthermore*), comparison/contrast (*similarly, likewise, in comparison, however, but, in contrast, on the other hand, nevertheless, nonetheless, despite, yet, still*), and inference (*therefore, thus, hence, so, as a result, accordingly*). Among them, additive (about 65%) and inferential (just above 15%) transitions registered as the most and least frequent logical devices in each sub-corpus (see Table 3). It seems that both sets of RAs commonly reflect a progressive argumentative style (Mauranen 1993b) based on the explicit signalling of addition.

	Non-Iranian sub-corpus		Iranian sub-corpus		Test statistic value	P value
	Raw	%	Raw	%		
Additive transitions	551	62.6	467	64.4	$t_{(38)} = 1.59$	.121
Comparative transitions	185	21.1	145	19.9	$t_{(38)} = 2.85$	.007
Inferential transitions	144	16.3	114	15.7	$U = 139.00$	.095

Table 3: Frequency of use of transitional markers in the two sub-corpora

The independent samples *t*-test run on additive transitions revealed a non-significant difference between the two sets of RAs, $p = .121$, $t_{(38)} = 1.59$. The same statistical test was used to compare differences in the incidence of comparative transitions, which yielded a significant difference between both datasets, $p = .007$, $t_{(38)} = 2.85$. Finally, the Mann-Whitney *U*-test run on inferential transition showed that there is no significant difference between the two groups of writers, $p = .095$, $U = 139.00$.

The textual analysis further showed that additive transitions allow the writers to explicitly define the key concept and provide a clarification. Such uses were evident in both datasets (74.2% vs 72.6%). Some examples are as follows:

Defining the key concept:

- (6a) *Furthermore*, it is well known that periodontal disease itself leads to significant localised alveolar bone loss via inflammatory reactions (Pihlstrom et al. 2005; Chung et al. 2009). [Int19]
- (6b) Another important factor is the parallelism of the maxillary anterior incisal curve and the lower lip and its asymmetry. *Moreover*, it appears that laypersons are capable of recognizing the characteristics of an ideal smile. [Ir11]

Provide clarification:

- (6c) *The Periostest assesses the damping capacity of the implant, although it is not useful to evaluate mesiodistal stability. In addition*, Periostest seems to be insufficient to detect small changes in implant stability, because [...]. [Int5]
- (6d) *Biofilm microorganisms have a greater chance of survival compared to microorganisms in water and planktons. They are also more resistant to antibiotics and agents capable of destroying planktons.* [Ir1]

In both sets of data, especially in the non-Iranian RAs (17.6% vs 11.7%), transitions such as the contrastive forms *however*, *but*, *despite*, were mainly used to start off statements of gap indication in the literature or counter-claiming. Such statements locate the present study in the context of past studies and claims by arguing how the study being reported seeks to plug the existing gap or warranting how the present study differs from relevant studies in the body of literature. Such contrastive forms are “antithetic discourse markers” that “exhibit connectivity and were sentence-initial concessive conjuncts appearing in the form of adversatives” (Lim 2012: 234). The use of a contrastive at the beginning of statements allows “writers to manoeuvre themselves into line with what they expect reader may think to head off objections or counterclaims” (Hyland 2004: 138). Some of the examples found in the corpus at hand are as follows:

Gap indication:

- (7a) *Concerning iNOS expression evaluation, similar level in both T0 samples and increased levels in T1 iliac crest sample compared to the T1 calvaria ones, are demonstrated, suggesting that [...]. However, this hypothesis needs to be confirmed by further investigations such as in vivo iNOS activity assay.* [Int20]
- (7b) *Bolton analysis can help orthodontists in treatment of patients with severe tooth size discrepancies. Nonetheless, it has some limitations and its precision and dependence to other factors are still matters of discussion.* [Ir8]

Counter-claiming:

- (7c) *However, even if autologous bone grafts demonstrated significantly higher new bone formation after sinus augmentation if compared with other bone substitutes (Browaeys et al., 2007; Danesh-Sani et al., 2017), their use is associated with major drawbacks such as [...].* [Int6]
- (7d) *Knowing the condylar movement after orthognathic surgery is important to prevent postoperative instabilities. However, condylar displacement within the physiologic capability of the adaptive mechanism does not lead to [...].* [Ir2]

Transitions were also used to construct interaction reflecting the interactive nature of metadiscourse. Inferential transitions, such as conjunctions, were utilized to show cause and effect so as to get the readers' acceptance for the significance of the study being reported through justifying the purpose of the study, as well as through claiming the centrality of new knowledge and contribution. Such uses were observed in the two datasets, with the Iranians using them almost twice as often as their non-Iranian peers (15.7% vs 8.2%). Text examples are:

Purpose of the study:

- (8a) *[...] to the best of the authors' knowledge, no investigations have been conducted yet focusing on the healing potential of sites with different bucco-lingual width within the same maxillary sinus. Therefore, the aim of this multicentre prospective study was to analyse new bone formation 6 months after lateral sinus floor elevation in different anatomical areas of the maxillary sinus.* [Int6]
- (8b) *Studies on the effect of xylitol-fluoride mouthwash in comparison with CHX on salivary S. mutans are limited. Thus, this study aimed to assess the effect of FX (Fuchs, Germany) mouthwash (combination of xylitol and 920 ppm fluoride) and 0.2% CHX (Behsa, Iran) on salivary S. mutans.* [Ir15]

Centrality claim:

- (8c) *Hence, it can be speculated that the augmented bone, irrespective of the preoperative defect morphology, is able to support the soft tissue in [...].* [Int15]
- (8d) *Biofilm microorganisms have a greater chance of survival compared to microorganisms in water and planktons [...]. Therefore, in the control of biofilms a general approach should be considered.* [Ir1]

3.2 Code glosses

Code glosses were used by the two groups of writers (see Table 2), indicating that ensuring readers grasp writers' intended meanings is one of the established

disciplinary propensities and conventions of which they are aware. Nevertheless, in line with previous findings (e.g. Abdi 2009, Attaran 2014, Mansoori et al. 2016), the non-Iranian sub-corpus displayed a statistically significant higher inclusion of code glosses than the Iranian sub-corpus (12.3 vs 9.6 instances per 1,000 words; $p = .001$, $t_{(27.1)} = 3.73$; see Table 2). The varied readership of the international publications may call for various clarifications designed to lead readers to the interpretations intended by the writers, which would explain such a significant difference.

‘Reformulation markers’ used to reformulate given information (Hyland 2007: 269, see also Murillo 2004, 2012, 2019) and ‘exemplificatory markers’ to support previously mentioned propositional content (Lee 2004: 298, Guziurová 2020) are the two types of code glossing devices occurred in the corpus. The former is signalled by the use of expressions like *that is*, *put another way*, *or*, *in the other words*, or punctuation marks (e.g. colon, dash, hyphen, parenthesis, comma, etc.), and the latter through observations such as *for example*, *for instance*, *including*, *i.e.*, *e.g. such as*, *namely*. As illustrated in Table 4, reformulation markers show very high frequencies across the corpus, especially in the non-Iranian sub-corpus (84.3% vs 72.9%). This could be attributed to the density of code glosses evidenced in the RAs written by the non-Iranian authors (see Table 2). The independent samples *t*-test run on reformulation markers revealed a significant difference between the two sub-corpora, $p < .001$, $t_{(22.8)} = 5.11$. However, no statistically significant difference was found in the inclusion of exemplificatory markers between the RAs in the Iranian and non-Iranian sets of data, $p = .717$, $t_{(38)} = 0.37$.

	Non-Iranian sub-corpus		Iranian sub-corpus		Test statistic value	P value
	Raw	Norm.	Raw	Norm.		
Reformulators	691	84.3	334	72.9	$t_{(22.8)} = 5.11$	< .001
Exemplifiers	129	15.7	124	27.1	$t_{(38)} = 0.37$	.717

Table 4: Frequency of use of code glosses in the two sub-corpora

The textual analysis also revealed that the two groups of writers use code glosses for similar functions, albeit to a different extent. The most prominent uses of reformulation markers were delimitation (35.8% by non-Iranians and 30.9% by Iranians, Examples 9ab) and elaboration (64.2% vs 69.1%, Examples 9cd). In the case of the former, the restatements in the second discourse units demarcate the scope of the propositional content in the first discourse units. By

contrast, in the case of the latter, the second discourse units further elaborate or clarify the first discourse units. Some examples are as follows:

- (9a) *Finally, the values for defect classification and for intra- and inter-rater reliability were higher in the second rating round than in the first round. **This means that the occurrence of learning bias cannot fully be excluded even though we tried to [...].** [Int4]*
- (9b) *However, there were significant differences between either the Geristore group or the Bioaggregate group and the control group ($P < 0.05$). **In other words, Geristore and bioaggregate induced more inflammation even after 60 days.** [Ir18]*
- (9c) *Periotest, **which was originally used for measurement of natural tooth mobility,** has also been applied to test implant stability [...]. [Int5]*
- (9d) *In contrast to cyclin D1, evaluation of other cell cycle proteins such as cyclin B1 (**showing transition from the G2 to the M phase of the cell cycle**) and Ki-67 (**which is expressed in all phases of the cell cycle but not in quies-cent cells**) demonstrated that only mononuclear cells were positive. [Ir9]*

Exemplificatory markers were very often used to explain technical and abstract concepts via more accessible examples (Examples 10ab) or to present specific instances of general propositions (Examples 10cd):

- (10a) *The diagnostic accuracy of defect detection, **i.e., presence of peri-implant defects (yes/no), and type classification were assessed by calculating sensitivity and specificity as well as [...].** [Int4]*
- (10b) *Hypodontia may be a dental manifestation of special syndromes **such as ectodermal dysplasia¹² and cleft lip and/or palate,** or occur as an isolated condition. [Ir20]*
- (10c) *The post-operative image served as baseline, and each forthcoming scan was registered with the previous one. **For example, week 1 was registered with week 0, week 2 with week 1, and so on.** [Int13]*
- (10d) *Bolton analysis can help orthodontists in treatment of patients with severe tooth size discrepancies. Nonetheless, it has some limitations and its precision and dependence to other factors are still matters of discussion. **For instance, Bolton's studied population and their ethnicity were not exactly specified; whereas, there is evidence regarding [...].** [Ir8]*

3.3 Endophoric markers

Like past studies (e.g. Zarei & Mansoori 2011, Mirhashemi & Alami 2013), endophoric markers were found with a similar frequency in the two sets of RAs (around 8 instances per 1,000 words; see Table 2). However, the independent

samples *t*-test run on the raw frequencies of endophoric markers as a group found a significant difference between the two groups of writers, $p = .037$, $t_{(38)} = 21.65$ (see Table 2).

The textual analysis showed that endophoric markers, which are explicit references to other parts of the text, include linear and non-linear referencing devices (cf. Bunton 1999, Mauranen 1993a), which appeared in both sets of data. Non-linear references (e.g. *as illustrated in Table X, refer to Fig X*) are used to point to visual aids (e.g. tables, figures), formulas, or sections (Example 11a). On the other hand, linear references are used to enhance explicitness in discourse. The latter appeared mostly in the non-Iranian sub-corpus (82.8% vs 71.4%; see Table 5) and acted as a forward/preview (e.g. *in the following section, as will be discussed latter*; Example 11b), an inward/overview (e.g. *this cross-sectional study, the present study*; Example 11c), and a backward/review (e.g. *as described earlier, as mentioned above*; Example 11d). The independent samples *t*-test on linear references yielded a significant difference between the two sub-corpora, $p = .001$, $t_{(27.5)} = 3.93$ (see Table 5). Unlike what happened in the case of linear references, the independent samples *t*-test run on non-linear references showed that there is no significant difference in the incidence of such interactive devices in the two sets of RAs, $p = .117$, $t_{(38)} = -1.60$.

- (11a) *The absolute values of the discrepancies (mean, SD and range) in x-axes, y-axes, z-axes, and the total 3-D are presented in Table 1.* [Int3]
- (11b) *As will be discussed later, the use of osseointegrated implant for the treatment of edentulism has become an increasingly widespread therapy [...].* [Int11]
- (11c) *Therefore, the aim of the present study was to investigate the effect of delayed irradiation and/or preconditioning of [...].* [Ir14]
- (11d) *As mentioned above, the complex system of bearing occlusal stress along a fixed bridge was divided into smaller and simpler elements for better understanding and analysis, with the use of FEA method.* [Ir14]

	Non-Iranian sub-corpus		Iranian sub-corpus		Test statistic value	P value
	Raw	%	Raw	%		
Linear references	432	82.8	281	71.4	$t_{(27.5)} = 3.93$	.001
<i>Inward/Overview</i>	241	55.7	176	62.6	$t_{(38)} = 4.23$	< .001
<i>Forward/Preview</i>	116	26.9	64	22.8	$t_{(38)} = 5.01$	< .001
<i>Backward/Review</i>	75	17.4	41	14.6	$U = 120.00$	.026
Non-linear references	90	17.2	113	28.6	$t_{(38)} = -1.60$	.117

Table 5: Frequency of use of endophoric markers in the two sub-corpora

Referring to Table 5, there is a higher density of inward referencing devices used in the rhetoric of the texts produced by Iranians compared to that of non-Iranians (62.6% vs 55.7%). In contrast, forward and backward referencing devices were more prevalent in the non-Iranian sub-corpus compared to the Iranian. Arguably, the non-Iranian writers are more mindful of guiding the readers through making references in the text. The independent samples *t*-test on inward/overview ($p < .001$, $t_{(38)} = 4.23$) and forward/preview ($p < .001$, $t_{(38)} = 5.01$) as well as the Mann-Whitney *U*-test on backward/review ($p = .026$, $U = 120.00$) revealed statistically significant differences between the two groups of RAs.

The textual analysis showed that the two groups of writers deploy endophoric markers for different uses. Their most prominent use was ‘announcing research outcome’ (87.9% by Iranians and 70.8% by non-Iranians; Examples 12ab). The writers also used endophoric markers to ‘present methodological procedures used in the study’, mainly by the non-Iranian authors (21.6% vs 12.1%, Examples 12cd). The last discourse function, which occurred only in the non-Iranian sub-corpus, was ‘introducing study descriptively and/or purposively’ (Example 12e). It constituted 7.6 per cent of the total endophoric markers identified in the non-Iranian sub-corpus.

- (12a) *The results showed that the distribution of the implant location in the upper and the lower jaw was very homogeneous (Table 1).* [Int18]
- (12b) *The present study showed a low bond strength value for delayed [...].* [Ir6]
- (12c) *OCP was prepared by mixing a calcium and phosphate solution as described previously.* [Int9]
- (12d) *In the present in-vitro study, the effect of delayed light-curing through a zirconia disc was evaluated on the mechanical properties of two types of resin cement.* [Ir10]
- (12e) *Therefore, this clinical study introduces a digital solution that uses evidence-based medicine as the basis for bone augmentation design before [...].* [Int17]

3.4 Evidentials

As for evidentials, while the difference between the two sets of RAs is not statistically significant ($p = .696$, $t_{(38)} = -0.39$; see Table 2), the frequency analysis showed that the Iranian dentistry writers, compared to their peers publishing in International ISI-indexed journals, have a greater reliance on crediting their propositional information via citing outside sources (16 vs 11 cases per 1,000 words; see Table 2). Such reliance could be attributed to the avoidance of mitigating strong certainty in claim-making. The avoidance is likely to reveal the

presence of greater subjectivity in an argument. Therefore, Iranian writers may feel a stronger obligation to provide support for their subject matter and express their familiarity with the relevant literature to the readers.

The textual analysis showed that both Iranian and non-Iranian writers represent the work of others in their own discourse through integral and non-integral citations. With integral citations, the authors incorporate cited sources into their arguments as in Examples 13abc, while in non-integral citations, which showed very high frequencies throughout the corpus (above 70%; see Table 6), they attempt to remove cited sources from their arguments and put them in footnotes or in brackets as in Example 13d. The independent samples *t*-test on non-integral citations found a non-significant difference between the two sub-corpora, $p = .255$, $t_{(38)} = 1.16$. Nevertheless, the Iranian sub-corpus displayed a statistically significant higher inclusion of integral citations than that of the non-Iranian, $p < .001$, $t_{(30.0)} = -6.08$.

	Non-Iranian sub-corpus		Iranian sub-corpus		Test statistic value	P value
	Raw	%	Raw	%		
Integral citations	127	17.4	219	28.7	$t_{(30.0)} = -6.08$	< .001
Non-integral citations	603	82.6	545	71.3	$t_{(38)} = 1.16$	.255

Table 6: Frequency of use of evidentials in the two sub-corpora

This study took a further step towards looking into how the authors project cited works into their own discourse. It was found that citations are manifested through three different ways: i) occurred on their own (Example 13a); ii) preceded by adjunct agent forms (e.g. *according to*; Example 13b); and iii) materialized by impersonal linguistic expressions, such as *other studies*, *previous research* (Example 13c).

- (13a) *In addition, Godoy-Bezerra et al. reported that conditioning the enamel with 10% polyacrylic acid [...]. [Ir16]*
- (13b) *In addition, according to Navimipour et al., the surface treatment of resin-modified glass-ionomer with Er,Cr:YSGG laser increased the bond strength of [...]. [Ir13]*
- (13c) *Other studies have evaluated the accuracy of the implant impressions by measuring interim plant distances of working casts [...]. [Int16]*
- (13d) *The original study population consisted of 72 patients as described in a previous study (Zitzman et al., 2001). [Int10]*

The textual analysis of evidence markers also revealed that the two groups of writers make references out of the text to: i) support their new findings (52.3% in the non-Iranian sub-corpus and 45.6% in the Iranian sub-corpus; Examples 14ab); ii) signal a reasonable and credible basis for the topic being studied (37.6% in the non-Iranian sub-corpus and 33.7% in the Iranian sub-corpus; Examples 14cd); and iii) justify experimental procedures applied in their study (20.7% in the Iranian sub-corpus and 10.1% in the non-Iranian sub-corpus; Examples 14ef). The first two discourse functions were evident in both sub-corpora, especially in the RAs written by non-Iranian authors. In contrast, the last use was more prevalent in the Iranian dataset than in the non-Iranian one.

- (14a) *Previous in vitro studies comparing splinted with non-splinted impression techniques also showed that [...].* [Int3]
- (14b) *In a study conducted by Muirhead et al. 87% of oral cancer patients also showed expression of Rb protein.* [Ir19]
- (14c) *In a 3-year follow-up report by Hutton et al. (1995), the implant failure rate in cases of mandibular implant-supported overdentures was 3.3% [...].* [Int12]
- (14d) *Based on the results of some recent studies the acid-base and photo-initiated free-radical reactions have a reciprocal [...].* [Ir3]
- (14e) *All implants were placed using a standardized surgical procedure (Buser et al. 2000).* [Int8]
- (14f) *This technique was introduced by Torneck in 1966 and confirmed by Olsson et al in 1981.* [Ir12]

3.5 Frame markers

The results of the frequency analysis show that framing devices used to outline text boundaries and partition the propositional content occurred with a similar frequency in the two sets of data (about 5 cases per 1,000 words; see Table 2). However, the independent samples *t*-test run on the raw frequencies of frame markers as a group yielded a significant difference between the two sets of data, $p = < .001$, $t_{(38)} = 4.29$ (see Table 2). In addition, the textual analysis revealed that frame markers are characterized by various devices used for different discourse functions in the two sets of RAs, albeit to a different extent: i) ‘sequencers’ (e.g. *first/second/finally, a/b, 1/2*; see Cao & Hu 2014) to order discourse-internal units (47.8% in the Iranian sub-corpus versus 26.4% in the non-Iranian; Examples 15ab); ‘announcers’ (e.g. *aim [to], focus [on], seek, investigate*; see Cao & Hu 2014) to announce discourse goals (60.8% in the non-Iranian sub-corpus versus 29.4% in the Iranian; Examples 15cd); iii) discourse-labels (e.g. *in summary*,

to *sum, thus far*; see Cao & Hu 2014) to label discourse stages (15.7% vs 9.3% in the Iranian and non-Iranian sub-corpora, respectively; Examples 15ef); and iv) ‘topicalizers’ (*coming back to, as regards, turning to, concerning*, see Cao & Hu 2014) to shift between topics (7.1% in the Iranian sub-corpus versus 3.5% in the non-Iranian; Examples 15gh).

To compare these frequencies, an independent samples *t*-test on sequencers and a Mann-Whitney *U*-test on announcers, discourse-labels, and topicalizers were run. The Mann-Whitney *U*-test on announcers yielded a significant difference between the two sets of writing, $p < .001$, $U = 9.00$. Unlike what happened in the case of announcers, no statistically significant differences were found in the incidence of sequencers ($p = .185$, $t_{(38)} = -1.35$, discourse-labels ($p = .458$, $U = 175.00$), and topicalizers ($p = .440$, $U = 174.00$).

	Non-Iranian sub-corpus		Iranian sub-corpus		Test statistic value	P value
	Raw	%	Raw	%		
Sequencers	91	26.4	107	47.8	$t_{(38)} = -1.35$	.185
Announcers	209	60.8	66	29.4	$U = 9.00$	< .001
Discourse-labels	32	9.3	35	15.7	$U = 175.00$	.458
Topicalizers	12	3.5	16	7.1	$U = 174.00$	.440

Table 7: Frequency of use of frame markers in the two sub-corpora

- (15a) *Patients were not accepted into the study if they met any of the following exclusion criteria: 1) active infection [...] 2) systematic disease [...] 3) treatment with radiation [...].* [Int7]
- (15b) *In this study application of circumferential and occlusal fibers led to ... which can be explained from two accepts. **First**, according to levers principle the anchorage... **Second**, in these biaxially braided fibers [...].* [Ir3]
- (15c) ***The aim of this study was to** investigate whether appropriately designed, screw-retained, full-arch prostheses retained by [...].* [Int1]
- (15d) *Therefore, **the purpose of this study was to** evaluate and compare the expression of cyclin D1 between aggressive and nonaggressive CGCGs of the jaws to define whether [...].* [Ir5]
- (15e) ***In general**, all 30 implants achieved good bone augmentation effect in both horizontal and vertical directions before the second-stage surgery [...].* [Int17]
- (15f) ***To summarize**, the various chemical components of complex materials, such as RMGIs might give rise to diverse clinical behaviors.* [Ir17]

- (15g) **Coming back to our example**, the VTW of the first curve is 726 Ncm [...]. **With respect to surface topography**, numerous experimental and clinical studies have shown that [...]. [Int18]
- (15h) **Regarding the clinical types in group II**, most patients had leukoplakia (15 leukoplakia patients, 10 OLP patients, and 5 OSMF patients). [Ir2]

4 Conclusion

This article reports on a comparative study of IMMs in English dentistry RAs written by Iranian and non-Iranian scholars. Drawing on Hyland's metadiscourse framework, the study examined the use of five types of interactive metadiscourse, together with their sub-types, in a comparable corpus of 40 RAs. The frequency analysis revealed that the Iranian sub-corpus displayed a statistically significant higher inclusion of IMMs as a group than the non-Iranian sub-corpus. The results further showed that the interactive categories and their sub-categories appeared across the corpus and, in most cases, the statistical analyses yielded statistically significant differences between the two sub-corpora.

Concerning the qualitative phase of the study, although most of the uses of IMMs were common in the two sets of RAs, albeit to a different extent, the textual analysis disclosed some rhetorical variations. For instance, 'introducing study descriptively and/or purposively' expressed by endophoric markers proved to be exclusive to the dentistry RAs written by Iranian authors. 'Announcing discourse goals' realized through announcers and 'ordering discourse-internal units' realized through sequencers were the discourse functions of frame markers occurred frequently in the non-Iranian sub-corpus and the Iranian one, respectively. In general, this research has convincingly shown significant differences in the expression of some interpersonal values in English academic written texts in international and national contexts.

Indeed, work on IMMs in academic writing, such as RAs, could give us crucial and practical hints to distinguish discipline-specific pragmatic and socio-rhetorical norms and conventions. The results of the study presented here can also have important implications for scholars who are used to working in different cultural and linguistic contexts. The pedagogical implications of this study should not be overlooked. The results of such studies could be harnessed to i) ameliorate aspects of language pedagogy, such as the teaching and learning of writing, especially RA, for academic purposes; and ii) raise novice writers' awareness of the socio-rhetorical and discursive norms and conventions required to meet the expectations of gatekeepers. However, this is a preliminary study and deserves to be replicated. Possible recommendations to arrive at more conclusive results are broadening the range of features for examination, such as including interactional resources; widening the range of sub-genres of RAs

under investigation, such as taking qualitative RAs on board for the analysis of IMMs; and enlarging the corpus.

Notes

¹ To control length variation and allow for the comparison between the two sets of data of unequal sizes, raw frequencies of IMMs were normalized following Biber et al. (1998) [(Raw frequency count/number of words in the text) x 1,000 = normalized frequency count].

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