TRANSITIVITY ANALYSIS OF RHETORICAL MOVES IN DENTAL RESEARCH ARTICLE ABSTRACTS: THAI AND INTERNATIONAL JOURNALS

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Abstract

Transitivity can be used as a stylistic device to elucidate writers' worldview through types of processes at the level of semantic construction. This paper aims to conduct a corpus-based transitivity analysis to compare tonal styles in each of the rhetorical moves between Thai and international dental research abstracts. The datasets were constructed upon 120 dental research article abstracts randomly selected from six Thai refereed dental journals (TDRAAs) and from top five international dental journals (IDRAAs) ranked by IF (Impact Factors), respectively. The datasets were analyzed based on six process types of Halliday and Matthiessen's (1994) and Thompson's (2000) verbal choices of transitivity. Although both datasets shared resemblances in terms of transitivity types found in each of the rhetorical moves, verbal and existential processes were only found in Methodology moves of TDRAAs. Verbal processes were also highlighted in Discussion moves of IDRAAs. The results can be used to raise awareness of pedagogical implications for ESP courses designed for Thai dental students. It also addresses the significance of tonal styles propelled by the process types of transitivity while researchers recount experiment-based dental research studies.

Keywords: Academic writing; English for academic purposes; genre analysis; dental research article abstract; transitivity

Background and Rationale

Experimental research articles can be recognized as mainstream in scientific studies. To present the researcher's innovation, research article abstracts are the first gateway for publishers to evaluate research quality (Rowley, 1988; Salager-Meyer, 1992). Writing successful abstracts is, however, considered a daunting and challenging task for non-native English speaking (NNES) writers. One of the approaches to provide guidance for abstract writing is through corpus-based move analysis (Samraj, 2002) where move frequency and move sequences are observed, and alternatively constructed upon communicative purposes in a discourse community. Some studies further address how each move consists of cohesive devices, hedges, boosters, and modalities which facilitate move identification (Salager-Meyer, 1990) Since move analysis is used to locate communicative purposes throughout an abstract, where identification of each move is realized at the macro-level, the lack of description at micro-level, specifically at tonal styles, poses an appealing question for the present study.

Considered as a specific genre, research articles in dentistry may be less well-known in genre analysis (Basturkmen, 2012). As writing a dental research article abstract for an international publication depends on a required style, transitivity can be used to understand a narrative point of view which is agreed upon by the dental community. Regarding the narrative point of view, transitivity has been employed by recent scholars and to explore how the speakers convey a message through their worldview (Simpson, 1993). To illustrate, transitivity is considered to be an "ideational metafunction," (Halliday, 1967) which focuses on a semantic interpretation chiefly derived from a particular type of process involved in the activity. However, the type of process cannot be interpreted or classified without the other two components in the clause: the participants and circumstances. The interpretation prompted by these three components found the relationship between the speaker's utterance and his/her viewpoint through grammatical perspective (Simpson, 1993; Halliday, 1994). Transitivity analysis thus plays a major role in demonstrating the writer's worldview in a situation uttered. As different types of processes can lead to an alternative worldview represented

by a writer, this study aims to compare the types of processes between international and Thai dental research article abstracts to provide stylistic guidelines for Thai dental students.

Literature Review

Systemic functional grammar (SFG) is established to illustrate how language functions as interconnected systems for making meaning. Conceptualized as a subdivision of SFG, transitivity was introduced by Halliday (1967) as an essential unit or system of ideational construction in any text. Based on cognitive grammar, ideational construction is one of the three metafunctions of SFG realized by lexicogrammar concepts, where the focus is on elucidating meaning of the underlying semantic options, categorized as types or processes, expressed in the clause (Flowerdew, 2013). Halliday (1971) further clarifies the relationship between clauses and the transitivity as "the set of options whereby the speaker encodes his experience of the processes of the external world, and of the internal world of his own consciousness, together with the participants in these processes and their attendant circumstances" (p.119). This point is specified by Simpson (1993) that participants, processes and circumstances can be signified by noun phrases, verb phrases and adverbial/prepositional phrases respectively. Halliday (1971, 1976, 1994) continuously applied the concept of transitivity on various types of texts to demonstrate how linguistic function linked to textual interpretations.

As one sentence grammatically consists of three elements: subject, verb and object, Wales (1989) defines transitivity as the meaning-making procedure which is affected by the elements addressed (p.466). Analyzing transitivity through individual utterances can display how the synchronized world is represented by the speaker/writer (Christie & Derewianka, 2008). In addition, Berry (1975), reaffirms that transitivity is the part of grammar which encodes the narrator and/or the author's view of reality, in accordance with the "who does what to whom?" grammatical viewpoint.

Transitivity is considered as a stylistic device implemented in literary linguistics and journalism studies (Halliday, 1971). It has been used in literary texts to understand how individual characters represent their immediate

experience and worldview through verbal acts. For instance, Halliday (1971) discovered two components mostly employed in *The Inheritors* through a great number of abstract nominals (circumstances) and animate subjects (participants). At the climactic point, the number of mental verbs was used to convey the protagonist's gradual "understanding by new things and events" (p.115). As with media and journalism studies, Montgomery (1986) employed transitivity analysis to investigate the types of processes used in radio disc jockey speech while they discussed the political conflicts during the British miner's strikes during the 1980s. Based on literary and journalist genres, Simpson (1993) built upon Fowler's (1986) framework to identify transitivity through aspects of experience: material, mental, relational, verbalized, existential.

Material process clauses represent the reality of "doing" and describe situations uttered through physical acts. The clauses mainly comprise the actor and the goal. If the clauses are acted by an animate actor, they are categorized as action processes where they can be subcategorized into intention and supervention. Moreover, material process clauses can be extended from physical events to events and happenings (Halliday & Martin, 1993).

Event process clauses, by contrast, are any occurrences demonstrated by an inanimate actor. Mental process clauses comprise Senser and Phenomenon and convey a means of internalized "sensing." Internalized processes can be subcategorized into perception (seeing, feeling), reaction (loving, hating) and cognition (conceiving, knowing).

Verbalized process clauses represent the act of "saying," comprising 3 main participant roles which are Sayer (addresser), Receiver (addressee) and Verbiage (nominalization).

Relational process clauses embody the sense of "being" and consist of 2 participant roles; Carrier, the topic of the clause; and Attribute, a description or remark about the topic. The processes can be subcategorized into Attributive, where a participant is an attribute of the other, and Identifying, where participants identify each other. In addition, relational processes serve as identifying and characterizing entities (Halliday & Matthiessen, 2004) and form comprehensive and accurate descriptions for readers.

Existential process clauses represent existence and are construed by there-construction, typically with the verb "be," where inclusion of human agency is diminished. Behavioral process clauses represent a notion of "behaving." They have only one participant, the Behaver, and it falls into the realm between material and mental processes. Since the focus of behavioral processes is based on human behaviors (laughing, smiling), they are uncommon in scientific writing (Halliday & Martin, 1993).

Table 1: Transitivity System

Processes	Material (Actor + Goal)	Action	Intention
			Supervention
		Event	
	Mental (Actor + Goal)	Internalized (Senser + Phenomenon)	Perception
			Reaction
			Cognition
	Verbalized	(Sayer + Receiver + Verbiage)	
	Relational	Attributive (Carrier + Attribute)	
		Identifying (Identifier + Identified)	
	Existential	(There-construction)	

As discussed above, transitivity can be conceptualized as ideational transmission, where meaning is weaved upon the syntactic structure. Burton (1982) indicated that application of transitivity to linguistic studies adhered to textual evidence rather than subjective interpretation derived by a "diversity of qualitative methods" (p. 196). Transitivity was not only used in literary texts to comprehend mental representations of fictional characters (Halliday, 1971; Short, 1976; Cunanan, 2011), but also in non-literary texts to study genre-specific features. For example, Yang (2001) studied the formation of transitivity in editorials and found that they were constructed by the intensity of material processes, followed by relational processes, because the writers intended to elaborate events with action verbs to ensure that readers could

understand the intended meaning. Another study found that students realized through the prominence of mental processes while writing interactive e-mails in English (Wu, 2004).

With respect to academic writing, transitivity analysis provided pedagogical insights for NNES students. For example, Martínez (2001) investigated the impersonal style of writing from a dataset of 21 experimental research articles in the fields of physical, biological and social sciences. The results revealed that there was a tension between the objectivity of the findings (through material processes) and the level of persuasion (through mental processes) established in each discipline. It concluded that the impersonal style of writing depended on choices of transitivity, as can be seen from the high percentage of relational processes in Result and Discussion moves where the writers could "keep maximal distance" from the text (p. 241). Exploring the level of objective writing, Zheng et al. (2014) conducted a corpus-based transitivity analysis on six process types in medical research articles, collected from five international medical journals. They found that the system of transitivity played a vital role in understanding ideological points of view, signified by occurrences of material processes (46.11%), relational processes (31.62%), mental processes (13.00%), verbal processes (6.39%) and existential processes (2.88%). The highest percentage of material processes empirically reflected the style of writing in medical discourse, especially in the Methodology move, to explain how the research was objectively illustrated.

Transitivity analysis was also incorporated with Swale's (1990, 2004) genre analysis to explain the stylistic differences found in rhetorical moves across disciplines or cultures. For instance, Pang & Chen (2007) investigated the features of transitivity in rhetorical moves of six research articles in psychology and materials science, and they reported that the occurrence of process types was different in four sections of a research article, resulting in various degrees of objectivity in the same research article. Sayfouri (2010) conducted a contrastive genre analysis between Iranian and American-English writers of medical research articles, and explored transitivity in the Discussion moves, finding that types of processes were relatively similar in the two groups. As previously mentioned, these findings highlight the significance of transitivity analysis, especially in English language teaching as guidance for

non-native English speaking (NNES) research article writers. Based on the previous literature, the lack of both genre analysis and transitivity analysis in the field of dental sciences poses a question to the development of writing guidelines in ESP courses for NNES students. This study therefore aims to compare the process types of transitivity found in Thai dental research article abstracts (TDRAAs) and international dental research article abstracts (IDRAAs). Eventually, the comparison between the two datasets could shed light on stylistic differences and provide pedagogic information for Thai dental students.

Methodology

1. Dataset Establishment

Two comparable datasets were originally written in English and compiled as representative datasets. The first dataset comprised 120 randomized Thai dental research article abstracts (TDRAAs), officially issued by Thai-Journal Citation Index (TCI) and distributed by dental schools in Thailand: *Chulalongkorn University Dental Journal (CDJ)*, *Mahidol Dental Journal (MDJ)*, *Chiang Mai Dental Journal (CMJ)*, *Kon Khaen Dental Journal (KKJ)*, *Srinakharinwirot University Dental Journal (SWJ)* and *Songklanakarin Dental Journal (SDJ)*. The second dataset also comprised 120 randomized international dental research article abstracts (IDRAAs) from the top five leading international dental journals based on their Impact Factor (IF) as shown in the ISI Web of Science database: *Journal of Dental Research (JDR)*, *Oral Oncology (OO)*, *Dental Materials (DM)*, *Journal of Clinical Periodontology (JCP)* and *Journal of Endodontics (JOE)*. Each original contribution abstract was an experiment-based research study published between 2012 and 2016, and had 200 to 300 words. Based on demographic data, all the TDRAAs were screened to ensure that they were written by Thai dental students who studied in an international dental program in Thailand. Their identities were checked and verified by their last names. Subsequently, emails were sent to all the corresponding authors to confirm that they had not studied in international faculties or had any extensive exposure working in an English environment and that their nationality was indeed Thai. The screening process was required to reduce likelihood of translated TDRAAs in the dataset.

2. Ranking Clauses and Transitivity

All abstracts were analyzed based on a nomenclature of Background, Purpose, Methodology, Result and Discussion (BPMRD) structure, a clear illustration of "a distinctive category of discourse" (Swales, 2001, p. 33). Each move was consequently compiled into isolated datasets of TDRAAs and IDRAAs respectively. Then, it was categorized into a particular type of process which was used to represent worldviews upon situations uttered. Since there might be more than one process per one move, each clause was ranked to extract only the main clauses for the comparative study. To illustrate, main clauses were analyzed through the transitivity system based on processes proposed Halliday (1994) and Thompson (2000). All subordinate clauses, or embedded clauses, were excluded, as can be seen from examples below.

One single ranking

///Enamel resin infiltrants are biomaterials able to treat enamel caries at early stages.///

One clause complex = One single ranking + ~~One embedded sentence~~

///The study identified single nucleotide polymorphisms (SNPs)
[[~~that associated with different occlusal relationship in a group of Thai population~~]]///

The identification of transitivity was not entirely straightforward since some clauses could be interpreted under more than one category, depending on the metaphorical meaning or ad hoc contexts (Halliday & Martin, 1993; Thompson, 2000; Martínez, 2001; Flowerdew, 2013). For example, the phrase *"play a major role"* is constructed upon the material process *"play"*; however, the meaning is metaphorical since this idiomatic phrase actually means *"involve,"* representing a relational process. To decrease the degree of subjectivity, inter-coder agreement was assessed to establish both validity and reliability of the analysis. A quarter of both datasets, as suggested by Kanoksilapatham (2005), were randomized, independently coded by an expert, and then compared to those independently coded by the researcher. The expert received her Ph.D. degree in Applied Linguistics and specialized in discourse analysis. The 60-minute preliminary training was provided to ensure that the

classification of transitivity by the researcher and the expert was thoroughly understood. Cohen's kappa (K) was also used to measure inter-coder agreement.

Results and Discussion

1. Transitivity Analysis

In the IDRAAs, as can be seen from Table 1, material processes had the highest frequency throughout the dataset, followed by relational, mental, existential and verbal processes. As for TDRAAs, as can be seen from Table 2, material processes had the highest frequency, followed by relational, mental, verbal and existential processes. The rarity of behavioral processes in scientific writings (Halliday & Martin, 1993; Zheng et al., 2014) was also evident in the study as none was found in either the IDRAAs or the TDRAAs

Table 2: Percentages of Process Types in TDRAAs

Type	Background	Purpose	Methodology	Result	Discussion	Mean
Material	28.74	60	87.42	25.76	32.38	46.86
Mental	13.79	31.11	3.79	1.84	9.66	12.04
Relational	41.39	6.67	8.16	56.32	47.73	30.48
Existential	14.94	0	0.23	8.96	2.27	6.88
Verbal	1.44	2.22	0.28	7.12	7.96	3.73
Behavioral	0	0	0	0	0	0

Table 3: Percentages of Process Types in IDRAAs

Type	Background	Purpose	Methodology	Result	Discussion	Mean
Material	32.6	72.8	86.09	43.46	31.93	53.38
Mental	6.67	22.06	5.04	2.02	4.23	8.01
Relational	51.85	2.94	8.87	44.67	46.94	31.05
Existential	4.44	0	0	5.03	1.4	2.17
Verbal	4.44	2.2	0	4.82	15.5	5.39
Behavioral	0	0	0	0	0	0

According to Tables 2 and 3, both datasets consist of mostly material processes which carry the sense of "doing" in the clauses. The following

examples display material processes through action verbs "produced," "created," and "prevented".

A.   *At the 4-mm level, groups A and B **produced** significantly higher PGFA than all other groups…* (JOE: 20 – Material)

B.   *The dual sputtering deposition technique **created** a HA/ TiO$_2$ hybrid structure.* (DM: 24 - Material)

C.   *Anti-TNF-α and antiseptic therapies **prevented** the development and exacerbation of infectious-PD.* (JCP: 20 – Material)

This reflects the nature of experiment-based research in dental journals because of the involvement of advancing technology and lucid illustration of actions is required. The findings correspond to Zheng et al.'s (2014) and Martínez's (2001) who found that academic research articles consist mainly of material processes.

2. Reliability and Categorization of the Process Types

Categorizing process types could be subjective as it also depended on the interpretation of the relationship among processes, participants and circumstances. Therefore, the agreement rates between the two coders were assessed (see Table 4). Overall, the level of agreement was nearly 90%, meaning that there was a high level of agreement and conformity. The results of Cohen's kappa (k) analysis (0.86) also pointed out that the inter-coder reliability was excellent.

Table 4: Inter-coder Agreement Rates

Moves	Coded Units	Agreement	Disagreement	Percentage
Background	55	50	5	90.9%
Purpose	56	50	6	90%
Methodology	284	274	10	96.67%
Result	233	208	25	89%
Conclusion	97	84	13	86.67%
Total	725	268	59	91.86%

2.1 Material Processes

Material process clauses represent the rigidity and objectivity of scientific writing (Halliday & Martin, 1993). As material processes underline the significance of the act between "subject" and "goals", the "process" was categorized based on the notion that the subject(s) "do/does" something. Main verbs mostly found throughout the datasets such as "collected," "prepared," "sectioned," or "placed" were examples of material processes demonstrating physical and visible acts (see below).

Table 5: Material Process

Actor	Pr: Material	Goal	Circumstance
The authors	*collected*	*juvenile alligator dental laminae*	*at different developmental stages.*

The present study reveals that material processes have the highest percentage in both datasets because they are used to describe research procedures as follows.

A.   *The labial surfaces of forty bovine incisor crowns **were ground** flat, exposing dentin. (CDJ: 4)*

B.   *Fourteen human canines **were prepared** according to be a standardized, conventional endodontic treatment protocol and filled with the HEC/calcium silicate sealer. (JOE: 4)*

The results substantiate previous studies focusing on genre-specific writing where material processes also have the highest percentage (Martínez, 2001; Yang, 2004; Darania, 2014). In addition, some studies claim that material processes cognitively predominate the others because the foundation of nature is mostly materialistic and full of activities (Simpson, 1993; Hu, 1994).

It should be noted that the Methodology moves in the two datasets have the highest percentage of material processes. This can be explained by

the writers' intention to display their concrete actions without interposing their personal reflections.

> /// (1) /Fifteen extracted human mandibular premolar teeth with single and straight roots were **used**. /// (2) After the clinical crowns were **removed** from the cementoenamel junction, // (3) root canals were **prepared** with the ProTaper (Dentsply Maillefer, Ballaigues, Switzerland) rotary system to the size of the F3 file./// (JOE: 18)

With regards to ranking clauses, the abovementioned shows that there are three ranking clauses identified in the Methodology move where the author elaborates steps of the experiment: tooth selection and canal preparation. All ranking clauses are material processes comprising Goal and Actor. Though the Goal is explicit by addressing the objects, the Actor, or the researcher, vanishes. The presence of material processes through material verbs such as "used", "removed" and "prepared" along with the absence of the researcher characterizes the impersonal style of writing where the focus is shifted to the Goal of research, not the Actor (Zheng et al., 2014).

2.2 Relational Processes

The second highest percentage of process types found was relational process clauses. The definition of relational processes is to do with "being" which denotes the relationship between two entities and is mainly informative in scientific writing (Halliday & Martin, 1993). As relational processes are subdivided into attributive and identifying relational processes, the present study comprised both subtypes of relational process clauses. The difference between attributive and identifying relational processes can be seen from the potential for reversibility where the positions of "carrier" and "attribute" can be switched without a corruption of meaning (Simpson, 1993; Halliday, 1994; Martínez, 2001; Flowerdew, 2013) as illustrated below (see Tables 6 and 7).

Table 6: Attributive Relational Process

Carrier	Pr: Relational	Attribute
The distance between the implant shoulder to 1ˢᵗ BIC	*was*	*2.51+0.7mm (lingual sites) compared to 3.64+0.8 mm for buccal sites (p<0.0001). (JCP: 3)*

Table 7: Identifying Relational Process

Type	Pr: Relational	Token
Symptom relief	*was*	*the primary expectation or an equally important expectation amongst the remaining 117 patients (58.5%; 95% CI 51.6-65.1%). (OO: 1)*

On the contrary, the attributive relational process is frequently used to elaborate scientific knowledge in dentistry, dental procedures and in the existence of significant findings. There are instances where the Carriers are accompanied by the Attributes as follows:

A: *For ACC and CPS, the MIC value for S. mutans **was** identical, and the MBC **was** similar with only a 1-step dilution difference (1:2). (JDR: 1)*
B: *Over 20% of patients **had** multiple complex coronary lesions. (JCP: 23)*
C: *Patient position **had** no effect on the efficacy of anesthesia of the IANB by direct technique. (MDJ: 3)*

Relational process clauses in example A are attributive as the Carriers "the MIC value for S. mutans" and "the MBC" are described as "identical" and "similar", respectively. These attributives signify new information for readers and are considered as reversible when the position of the Carrier and Attribute can be relocated.

Defining terminology through identifying relational processes is required to give readers sufficient background within the condensed space of an abstract. Identifying relational processes mostly appear when clarification of key terms is needed in a complicated scientific experiment. The definition

of terminology or descriptions provide relevant information which helps readers understand important issues under discussion as follows:

A: *Decreased ADAM-0 expression in OLP epithelium **suggests** reduction of epithelial differentiation, whereas enhanced PCNA expression in OLP epithelium **suggests** induced epithelial proliferation. (CDJ: 20)*

B: *Without dilution, F68 sealer **showed** the significantly highest cell viability (at 79%) among the experimental sealers. (MDJ: 2)*

C: *The specimen treated with distilled water **demonstrated** the most far liquid penetration into the center of the specimen, followed by the slurry water and microfilm, respectively. (MDJ: 4)*

Example B, for instance, represents identifying relational process because the Identifier "F68 sealer" is described as "the significantly highest cell viability (at 79%) among the experimental sealers." The description provides specific information for readers to understand the prestige of a F68 sealer in comparison to other types of root canal sealers. Example C shows that the Identifier "the specimen treated with distilled water" is identified as having "the most far liquid penetration into the center of the specimen." It is apparent that the Identifier and the Identified drawn from the examples given can be reversible and similar in meaning. Identifying relative processes is a means of providing information for topics in discussion and enriching argumentation in the making.

According to Halliday and Martin (1993), relational processes relegate actions into nominalizations and diminish the use of human agency with the proposition that one entity affects the other in a clause. In other words, writers decline the involvement of human agency and focus more on the relation between two entities, presenting information in terms of factual contribution. Throughout the datasets, relational processes serve as supplementary descriptions to material processes, characterizing texts into more informative and less mechanical papers.

2.3 Mental Processes

As discussed above, mental process clauses consist of "Senser" and "Phenomenon," and it is unusual to see mental processes in scientific writing (Halliday & Martin, 1993). Since the writers tend to reduce the involvement of individual thoughts, the percentage of mental processes in IDRAAs and TDRAAs are 12.04% and 8.01% respectively, showing that mental processes are hardly used in the datasets in this study. IDRAAs frequently use "we" or "the authors" as the Senser to represent their mental involvement. However, when a clause is told from a participating narrator with either unreflective comments or the lack of modalities (Simpson, 1993; Beaver, 2001), the narrator's reliability is textually projected, resulting in the efficiency and intensiveness of the results as follows:

A: *We* **hypothesized** *that temporal escalation in stress exacerbates risk for TMD, and the effect is amplified by allelic variants in a gene, catechol-O-methyltransferase (COMT), regulating catechol neurotransmitter catabolism. (JDR: 12)*

B: *The supplementation of other bone-augmenting agents is* **considered** *helpful in preventing such side effects by reducing the amount of BMP-2. (JDR: 9)*

As can be seen from Example A, the word "hypothesized" suggests mental activity of the researcher, with "we" entailing their thought "that temporal escalation in stress exacerbates risk for TMD." As a result, the Senser "we" conveys realistic representation from human agency and, TDRAAs and IDRAAs use mental processes a lot, with in addition, readers perceive the narrators' reliability through a collectivistic viewpoint. For persuasive purpose, mental processes have been used in various types of academic journals (Wu, 2004; Zheng et al., 2014). Likewise, it is apparent that it gaining the highest percentage (31.11% and 22.06%) in Purpose moves where the researchers' reliability and determination can be unified.

2.4 Verbal Processes

Verbal process clauses consist of Sayer, Receiver and Verbiage and refer to the process of "saying." In this study, verbal processes are frequently found in the Result and Discussion moves, especially when the writer suggests findings for implications. When compared to the other types, verbal processes become uncommon in TDRAAs (6.88%) and IDRAAs (2.17%).

A: *...the bone grafting is strongly **recommended** in immediate implant placement case, especially in aging patient, in order to create the esthetic and primary stability.* (*CMU*: 10)

B: *Recent studies have **shown** that native phosphorylated full-length porcine amelogenin (P173) and its predominant cleavage product (P148) can inhibit spontaneous calcium phosphate formation in vitro by stabilizing an amorphous calcium phosphate (ACP) precursor phase. (JDR: 4)*

As with Example A, Sayer and Receiver are identified in the clause. However, the Sayer "the bone grafting" is not actually represented through human agency, but as a signal (Simpson, 1993; Halliday, 1994) indicating the researcher's recommendation. In other words, the researcher's attitude is expressed through the clause where the act of recommendation occurs. The Receiver in this situation is the reader, who is being "recommended in immediate implant placement case." In example B, the clause represented a case of Verbiage, where a nominal group functions as a participant in the process (Halliday, 1994), because the verb "have shown" is the source of projection addressing "native phosphorylated full-length porcine amelogenin (P173) … calcium phosphate (ACP) precursor phase" as Verbiage.

Implications constructed upon verbal processes could be linked to the writer's authoritativeness which is significant in strengthening their argument under discussion as follows:

C: *A limited number of in vivo studies have **discussed** the prevalence of middle canals in root canal systems of mandibular molars. (JOE: 11)*

D: We previously **reported** a systemic hyperinflammatory response to bacterial lipopolysaccharide (LPS) in children with localized aggressive periodontitis (LAP). (JDR: 6)

"A limited number of in vivo studies" in Example C is found in the Background move to point out the research gap as Sayer. Verbiage; "the prevalence of middle canals in root canal systems of mandibular molars" preludes new discovery of dental treatment which strengthens the purpose of the study. According to Yang (2004), verbal processes are mostly found in political speeches while responding to news reporters as they transmit both the source authenticity and the speaker's trustworthiness. At this juncture, the effect of verbal processes makes the utterances realistic and persuasive to the reader. This can be seen from Example D where Sayer "we," represented by a group of researchers, and Verbiage "a systemic hyperinflammatory response to bacterial lipopolysaccharide (LPS)…" are used to reassure readers of the significance of their preceding study.

2.5 Existential Processes

Existential process clauses characterize the existence of an entity with only one participant. The participant or Existent is realized by its subject "there." While the other types of processes found a relationship between participants and circumstances, existential processes diminish human agency and dislodges the relationship between entities. This study shows that the mean percentage of existential processes was the lowest overall.

A: **There was** no statistically significant difference in retention status for subjects having resin-based fissure sealant with adhesive and glass ionomer sealant in both periods of evaluation. (MDJ: 12)

B: **There were** no significant differences between EndoVac, EndoActivator, and the passive extrusion groups. (JOE: 8)

In Examples A and B, Existents "no statistically significant difference" and "no significant differences …", are displayed respectively as solitary participants without circumstances. Since there is no human agency to

manipulate actions or processes, the clause becomes objective at the discourse level. In fact, Jin (1996) reiterates this point that the degree of objectivity is highlighted while using existential processes. In spite of this, the lowest percentage reveals that there is only occasional use of existential processes in IDRAAs. When compared to IDRAAs, the two-fold increase of existential processes (15.5%) found in the Discussion move of TDRAAs fosters cautious optimism with respect to pedagogy in ESP.

3. Comparison of Process Types in Transitivity

Abstracts are considered a viable gateway for researchers to present their original contribution to the world of scientific knowledge. Transitivity analysis entailed generic pattern (BPMRD) of the abstracts with ideational transmission characterized by rhetorical moves. Also, it is broadly acknowledged that scientific writing attempts to be materialistic, objective, neutral and passive (Nwogu, 1997). The findings from transitivity analysis suggested that dental research article abstracts consisted of various types of processes and provided empirical evidence that scientific writing is somewhat elusive, not simply objective.

In other words, the importance of categorizing transitivity has focused attention on the realization of the stylistic features whether the text is represented as objective (material, existential), subjective (mental), informative (relational process), persuasive or argumentative (verbal). Throughout the datasets, material processes are the most prominent, which reflects the worldview of dental researchers as outcome-based and objective. Relational processes are used to clarify significant information for readers and establish the relationship between two entities. As more than 75% of the datasets comprises material and relational processes, the latter complements the prominence use of material process, leaving the impression that objective and informative styles were mostly used. On the contrary, mental and verbal processes are occasionally used to serve as persuasive and argumentative tone. Though existential processes were deemed objective with respect to there-construction and solitary participant, its low percentage could suggest the stylistic preference of dental researchers use more of material processes to describe what is done rather than what exists. The highlight of transitivity

analysis, however, is at the level of each rhetorical move where the tonal styles display.

While genre analysis can reveal rhetorical moves based on communicative purpose, transitivity is associated with the researchers' mental representation construed by process clauses. Based on different types of processes, the clauses could convey different tones; for example, in Background move, it includes apposite information for readers to understand background and rationale of research studies. This study reveals that relational processes, followed by material processes, are mostly used in Background move of both datasets and this suggests informative and objective writing style. The move resonates Swales's (2004) introduction calling readers' attention and characterizing the specificity of research. Arrington and Rose (1987) also points out that the introduction consists of a mixture of authoritative and sincere stances. The rarity of verbal processes in the Background move of the two datasets indicates that expressing individual opinions or judgements is not conventional in this move.

For the Purpose move, both datasets comprise mostly of material and mental processes as they encompass action and determination while conducting a research study. While relational and verbal processes are rarely used, there is no existential process found within the Purpose move. The similarity suggests that stylistic features of the two datasets are comparable whenever the Purpose move is written.

For the Methodology move, the percentage of material processes is dominant because dental researchers illustrate a means of research procedures, descriptions of research tools and advanced technology. Most material processes are constructed upon passive voice and an agentless structure, focusing on how research is conducted, how the samples are collected and selected and how the data is statistically analyzed. This move has a low frequency of mental and existential processes. However, the main difference between TDRAAs and IDRAAs is the incidence of existential and verbal processes, which is only found in the former. This would imply that TDRAAs may unintentionally choose inappropriate verbal choices while elaborating research procedures in this move.

The Result move usually reports findings, and relates to statistical analysis with writers' judgment, interpretation, comments and opinions (Brett, 1994). Apparently, verbal processes are more frequently used to express the researcher's personal voice when compared to the previous moves. However, both datasets show that relational processes are the most common, followed by material processes and existential processes. This concludes that DRAAs continue to report findings while avoiding subjective evaluation and aims to clarify the results. However, while TDRAAs informatively explain the results with relational processes, IDRAAs use material processes to explain how to arrive at the results.

In the Discussion move, most scientific writers usually interpret data in relation to other studies to establish innovative knowledge, original contribution or implications (Basturkmen, 2012). Relational processes are primary premises of the writers' withdrawal from idiosyncrasy, and material processes are evidently shown as the researcher's objective preoccupation. By contrast, both datasets have a low percentage of mental processes where provision of persuasive and argumentative tone has been established. The occurrences of mental processes, nonetheless, may not be perceptible when compared to the number of verbal processes extensively manifested in the two datasets. Also, it should be noted that the percentage of verbal processes of IDRAAs (15.5%) triples when compared to its Result move (4.82%), and mostly doubles that of TDRAAs (7.96%) in the Discussion move. This upsurge demonstrates the expressive tonal style where IDRAAs prefer vocalizing their contribution to readers as well as suggesting implications for further studies to literally being objective.

In particular, although Background move is informative through the high frequency of relational processes, the discovery of existential processes in this move may stem either from the modesty of Thai society or from the Thai writers' lack of guidance for abstract writing. In addition, the stylistic pattern in Result move mostly consists of relational processes; nevertheless, the higher frequency of material processes in the IDRAAs demonstrates that the international writers focus more on the causative actions of research procedures than the byproducts. Finally, the stylistic pattern in Discussion

move is, to some extent, built upon the use of verbal processes that the international writers use as a strategy to convince global readers. In addition to genre analysis, the findings through transitivity analysis could be linked to the context of Thai society and used to facilitate stylistic guidelines for Thai dental students.

Conclusion

Transitivity system is useful to understand the writers' ideational transmission based on the comparison of process types in rhetorical moves. In the light of genre analysis, each rhetorical move has its communicative purpose and serves to understand ways of communicating in a discourse community. As can be seen from the findings, there are various types of processes used to communicate with readers. The comparison of transitivity analysis between IDRAAs and TDRAAs offers pedagogical implications for Thai dental researchers because the stylistic differences between the two datasets trigger cautious optimism where appropriateness is required to achieve such a successful abstract writing. Genre analysis may give learners an opportunity to learn how communicative purposes are transmitted through texts (Swales, 2004; Kanoksilapatham, 2013); however, it does not appeal to signify their point of view at the semantic level. Though BPMRD apparently is a broad perception of generic structure used in research article abstracts, transitivity analysis significantly indicates how the texts are stylistically displayed. It is important to raise the awareness of ESP teachers over how to choose and identify types of processes according to the "voice" which is preferred and recognized by international publishers. To yield successful international publication, provision of transitivity types and concrete examples can be emphasized so that Thai dental students and/or researchers understand how a syntactic structure matters towards corresponding readers, if not specifically at the discourse level.

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