UNIVERSIDADE DE PASSO FUNDO

Roberta Neuwald Pauletti

ASSOCIAÇÃO ENTRE FUNÇÃO MASTIGATÓRIA E MANIFESTAÇÕES ESOFAGOGÁSTRICAS BENIGNAS EM PACIENTES EXAMINADOS COM ENDOSCOPIA DIGESTIVA ALTA: UM ESTUDO TRANSVERSAL

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Tese apresentada ao Programa de Pós-Graduação em Odontologia da Faculdade de Odontologia da UPF, para obtenção do título de Doutor em Odontologia – Área de Concentração em Clínica Odontológica, sob orientação do prof. Dr. **Fernando Fornari**

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SUMÁRIO

LISTA DE TABELAS

LISTA DE FIGURAS

LISTA DE ABREVIATURAS

DRGE	Doença do refluxo gastroesofágica
GERD	Gastroesophageal reflux disease
DREN	Doença do refluxo endoscopicamente negativa
DE	Doença erosiva
AINE	Anti-inflamatórios não esteroidais
GI	Gastrointestinal
STROBE	Strengthening the reporting of observational studies in epidemiology
BMI	Body mass index
PPI	Proton pump inhibitors
SD	Standard deviation
PR	Prevalence ratio
DAG	Directed acyclic
SPSS	Statistical Package for the Social Sciences
PDS	Post prandial distress syndrome
EPS	Epigastric pain syndrome
HP	Helicobacter pylori
R4DQ	Rome IV diagnostic quesionnaire for adults

RESUMO[1]

A mastigação é o primeiro estágio do processo digestivo, permitindo a trituração inicial dos alimentos mais sólidos e a mistura do bolo alimentar com a saliva. Teoricamente, a função mastigatória comprometida poderia dificultar o trânsito esofágico durante a deglutição e exigir trabalho adicional do estômago no preparo do quimo. Os objetivos deste estudo foram avaliar se a redução da função mastigatória prediz DRGE e disfagia esofágica e avaliar a relação entre mastigação e dispepsia. Estudo transversal, onde 179 pacientes adultos encaminhados para endoscopia digestiva alta eletiva aceitaram participar. Antes da endoscopia, uma dentista especialista realizou um exame oral e aplicou um questionário para avaliar a função mastigatória e classificar essa em três níveis (normal, regular e reduzida). Os pacientes ainda responderam questionários para avaliação de xerostomia, DRGE (pirose, regurgitação e disfagia) e dispepsia (Roma IV), possibilitando a classificação dessas manifestações

[1] Roberta Neuwald Pauletti

em conjunto com o exame endoscópico. Os resultados foram divididos em dois artigos, sendo que num artigo estudou-se a associação entre função mastigatória com DRGE e disfagia esofágica e noutro, a função mastigatória com dispepsia. As associações foram estimadas por meio da regressão de Poisson [originando a razão de prevalência (RP) e seu respectivo intervalo de confiança de 95%)]. Dos 179 pacientes, onze foram excluídos da análise devido a cirurgia esofagogástrica (9), neoplasia (1) e exame endoscópico incompleto (1). Dos 168 analisados, 46 apresentavam função mastigatória reduzida (27,4%) e 122 função mastigatória regular/normal (72,6%). Mastigação reduzida foi associada à DRGE [RP = 1,38 (IC 95% 1,12 – 1,70)], ajustando para idade, e associada à disfagia esofágica [RP = 2,03 (IC95% 1,02 – 4,04)], ajustando para idade e xerostomia. Após, vinte e um pacientes foram excluídos devido a lesões orgânicas relevantes (esofagite de refluxo e úlcera péptica), restando 147 pacientes com doenças não orgânicas para estudo de dispepsia funcional. Destes 147, 40 (27,2%) apresentavam função mastigatória reduzida e 107 (72,8%) mastigação regular/normal. Após o ajuste para idade e xerostomia, mastigação reduzida foi associada à síndrome do desconforto pós-prandial [RP = 1,84 (IC 95% 1,19 – 2,85)], mas não com síndrome da dor epigástrica [RP = 0,98 (IC 95% 0,64 – 1,50)]. Em pacientes ambulatoriais encaminhados para endoscopia digestiva alta, a redução da função

mastigatória pode ser um fator de risco para DRGE, disfagia esofágica, e dispepsia do tipo síndrome do desconforto pós-prandial. Uma abordagem interdisciplinar entre médicos e dentistas pode ser benéfica para pacientes com manifestações esofagogástricas benignas, como DRGE, disfagia esofágica e dispepsia.

Palavras-chave: Mastigação; Disfagia; Refluxo gastroesofágico; Dispepsia; Síndrome do desconforto pós-prandial.

ABSTRACT[2]

Mastication is the first stage of the digestive process, allowing for the initial crushing of more solid foods and mixing of the bolus with saliva. Theoretically, compromised masticatory function could hinder esophageal transit during swallowing and required additional work from the stomach in preparing the chime. This study aim to assess whether reduced masticatory function predicts GERD and esophageal dysphagia and to assess the relationship between mastication and dyspepsia. In this cross-sectional study, 179 adult patients referred for elective upper digestive endoscopy accepted to participate. Before endoscopy, an expert dentist performed an oral examination and applied a questionnaire to assess masticatory function and classify in three levels (normal, regular, and reduced). The patients also replied questionnaires for xerostomia, assessment of GERD (heartburn, regurgitation, and dysphagia), and for assessment of dyspepsia (Rome IV), thus together with endoscopy exam, classify these

[2] Association between masticatory function and benign esophagogastric manifestations in patients examined with upper digestive endoscopy: a cross-sectional study.

manifestations. The results were divided into two papers, one evaluating associations between masticatory function with GERD and esophageal dysphagia and in another, masticatory function with dyspepsia. The associations were estimated using Poisson regression [giving rise to the prevalence ratio (PR) and its respective 95% confidence interval]. Of the 179 patients, eleven were excluded from the analysis due to esophagogastric surgery (9), neoplasm (1) and incomplete endoscopic examination (1). Among 168 analyzed, 46 had reduced masticatory function (27.4%), and 122 had regular/normal mastication (72.6%). Reduced mastication was associated with GERD [PR = 1.38 (95%CI 1.12 – 1.70)], adjusting for age, and with esophageal dysphagia [PR = 2.03 (95%CI 1.02 – 4.04)], adjusting for age and xerostomia. Afterwards, twenty-one patients were excluded due to relevant organic lesion (reflux esophagitis and peptic ulcer), leaving 147 patients with non-organic diseases for the study of the functional dyspepsia. Among 147, 40 (27.2%) had reduced mastication and 107 (72.8%) had regular/normal mastication. After adjusting for age and xerostomia, reduced mastication was associated with post-prandial distress syndrome [PR = 1.84 (95%CI 1.19 – 2.85)] but not with epigastric pain syndrome [PR = 0.98 (95%CI 0.64 – 1.50)]. In outpatients referred for upper gastrointestinal endoscopy, reduced masticatory function may be a risk factor for GERD, esophageal dysphagia, and dyspepsia of

the post-prandial distress syndrome type. An interdisciplinary approach with physicians and dentists might be beneficial for patients with benign esophagogastric manifestations such as GERD, esophageal dysphagia and dyspepsia.

Keywords: Mastication; Dysphagia; Gastroesophageal reflux; Dyspepsia; Post-prandial distress syndrome.

INTRODUÇÃO

O sistema mastigatório representa a primeira fase do processo digestivo, tem a função de esmagar os alimentos em pequenos pedaços, para permitir a deglutição e facilitar a digestão no estômago e intestino (PESCE et al., 2015). A saúde do sistema gastrointestinal pode ser ajudada por uma mastigação eficiente, porém isso ainda é bastante controverso na literatura (SUMONSIRI et al., 2019). Alguns fatores podem ser considerados de risco para função mastigatória deficiente, como tabagismo, sexo masculino, envelhecimento e baixo nível de educação (FEIZI et al., 2016).

A função mastigatória está positivamente relacionada a uma vida com condições saudáveis, em adultos mais velhos, e está associada a uma expectativa de vida ativa estendida (HIRONAKA et al., 2015). Sabe-se que esta é um fator importante para a preservação da saúde geral (FEIZI et al., 2016). A percepção dos pacientes sobre sua mastigação é indicada pela capacidade mastigatória como resposta subjetiva à função, e a

habilidade mastigatória é menor em pacientes portadores de doenças como depressão, ansiedade e estresse (ROOHAFZA et al., 2016).

A endoscopia digestiva alta é comumente realizada para diagnóstico e vigilância de condições prevalentes como a doença do refluxo gastroesofágico (DRGE) e a síndrome dispéptica. A DRGE é entidade crônica caracterizada pelos sintomas típicos de pirose e regurgitação (KAV, 2017). Costumam comprometer significativamente a qualidade de vida e é uma das doenças mais prevalentes no mundo. No Brasil, sua incidência é de 12% (HENRY, 2014; KAV, 2017).

Uma pessoa saudável geralmente tem episódios de refluxo do conteúdo gástrico para o esôfago, pois é um evento fisiológico (BREDENOORD; PANDOLFI; SMOUT, 2013). A Doença do Refluxo Gastroesofágica (DRGE) é uma condição que se desenvolve quando esse refluxo do conteúdo gástrico causa incômodos ou complicações (VAKIL et al., 2006). A patogenia da DRGE é complexa e envolve alterações na exposição ao refluxo, resistência epitelial e sensibilidade visceral. O refluxo gástrico prejudica o estômago e provoca sintomas por ser um material nocivo (TACK; PANDOLFINO, 2018).

Para o diagnóstico da DRGE, é fundamental um bom exame anamnésico, com especial análise dos sintomas típicos e atípicos; a endoscopia digestiva alta e pHmetria esofágica são os

métodos mais sensíveis de diagnóstico (HENRY, 2014). Em achados endoscópicos gastrointestinais superiores, a DRGE pode ser classificada como doença do refluxo endoscopicamente negativa (DREN) e doença erosiva (DE) (TEIXEIRA; TANAJURA; VIANA, 2019).

A deglutição é um processo complexo que requer interação e integração de consciência e coordenação precisa de vários grupos musculares da cavidade bucal e faringe sendo que, danos a qualquer parte desse processo, pode resultar em descompensação e disfagia subsequente (SASEGBON; HAMDY, 2017). Sendo assim, a triagem precoce para deglutição e função mastigatória é essencial para prevenir ou retardar o aparecimento de complicações (LU et al., 2020).

A dispepsia é uma doença complexa, que apresenta vários mecanismos potenciais, incluindo motilidade intestinal anormal, hipersensibilidade visceral, fatores genéticos, infecciosos/pós infecciosos e psicossociais; é um conjunto de sintomas que se apresenta com elevada frequência na população em geral (OVERLAND, 2014). Essa síndrome pode ser a manifestação de várias doenças orgânicas, sistêmicas ou metabólicas (dispepsia orgânica ou metabólica) ou não ter causa óbvia (dispepsia funcional) (CARMONA-SÁNCHEZ et al., 2017).

A prevalência de dispepsia é significativamente maior em pessoas do gênero feminino, fumantes, usuários de anti-

inflamatórios não esteroidais (AINES) e indivíduos positivos para Helicobacter pylori, embora essas associações tenham sido modestas (FORD et al., 2014). A dispepsia não investigada teve prevalência de 21%, variando entre os países onde foi investigada (FORD et al., 2014).

Componente essencial da qualidade de vida, a saúde bucal faz parte da saúde geral e, por muito tempo, foi determinada apenas pela clínica, não sendo possível avaliar o verdadeiro impacto das doenças bucais no cotidiano dos pacientes. Embora a maioria dos problemas bucais não apresente risco imediato de morte, eles são responsáveis por diminuir a qualidade de vida dos indivíduos, pois prolongam seus estados de dor e sofrimento e causam problemas funcionais, estéticos, nutricionais e psicológicos (SPANEMBERG et al., 2019). Para diminuir os fatores de risco que afetam a qualidade de vida, é de extrema importância adquirir bons hábitos de saúde e, principalmente, de saúde bucal desde os primeiros anos de vida (SPANEMBERG et al., 2019).

Um maior tempo de esvaziamento gástrico para fazer a quebra de alimentos mal mastigados pode levar a problemas esofagogástricos, visto que indivíduos com maior dificuldade mastigatória podem apresentar tal condição. Além disso, pacientes adultos e idosos, com graus diversos de disfunção mastigatória são comuns na prática médica e odontológica.

PROPOSIÇÃO

Objetivo Geral

Este estudo tem como objetivo avaliar a associação entre função mastigatória e manifestações esofagogástricas benignas em pacientes examinados com endoscopia digestiva alta.

Objetivos Específicos

Os objetivos específicos são:

1. Avaliar se a redução da função mastigatória está relacionada com DRGE e disfagia esofágica, em pacientes investigados com endoscopia digestiva alta.
2. Avaliar a relação entre mastigação e dispepsia.

Esse estudo se justificou, por não estar bem definido na literatura as possíveis relações entre limitações da função mastigatória e manifestações esofagogástricas benignas.

Nossa hipótese alternativa é que a função mastigatória comprometida pode determinar manifestações esofagogástricas benignas, como DRGE, disfagia esofágica e dispepsia, em pacientes examinados em centros de endoscopia digestiva.

ARTIGO SUBMERIDO À DIGESTIVE AND LIVER DISEASES*

ARTIGO I

Reduced masticatory function predicts gastroesophageal reflux disease and esophageal dysphagia in patients referred for upper endoscopy: a cross-sectional study[3]

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Abstract

Background: The role of mastication on gastroesophageal reflux disease (GERD) is unknown. **Aims:** To assess whether reduced masticatory function predicts GERD and esophageal dysphagia in patients investigated with upper endoscopy. **Methods:** In this cross-sectional study, 179 adult patients referred for elective upper gastrointestinal endoscopy agreed to participate. Before endoscopy, an expert dentist performed an oral examination and scored chewing function in three levels (normal, regular, and reduced). Patients replied questionnaires for assessment of GERD (heartburn, regurgitation, and dysphagia), xerostomia, and mastication (normal, regular, and reduced). Poor chewing was defined when either oral examination or mastication questionnaire rated the chewing function as reduced. Associations of mastication with GERD and dysphagia were estimated using Poisson regression. **Results**: Eleven patients were excluded. Among 168 analyzed (aging 49.8 ± 15.5 years; 58.9% women), 46 had reduced masticatory function (27.4%), and 122 had regular/normal mastication (72.6%). Reduced mastication was associated with GERD [PR = 1.38 (95%CI 1.12 – 1.70)], adjusting for age, and with esophageal dysphagia [PR = 2.03 (95%CI 1.02 – 4.04)], adjusting for age and xerostomia. **Conclusions**: In outpatients referred for upper gastrointestinal

endoscopy, reduced masticatory function defined by an expert dentist may be a risk factor for GERD and esophageal dysphagia.

Keywords: Dysphagia; Gastroesophageal reflux disease; Mastication.

INTRODUCTION

Gastroesophageal reflux disease affects 13% of the worldwide population [1] and is typically an outpatient medicine disease. Patients with GERD usually complain of heartburn and acid regurgitation [2, 3], with a smaller proportion reporting atypical symptoms, including chronic cough, chest pain, and dysphagia [4]. A complementary investigation is often requested, particularly with upper gastrointestinal (GI) endoscopy, which can objectively confirm the diagnosis of GERD in the presence of moderate/severe reflux esophagitis [5]. However, most patients with GERD have unrevealing endoscopy or a hiatal hernia in the absence of mucosal breaks [6].

The pathophysiology of GERD is complex and involves several mechanisms not only in the esophagus but also in adjacent and distant anatomical sites including the stomach, mouth and brain [7, 8]. The most studied oral factor is the salivary function, which acts on esophageal clearance by its buffer capacity and cleaning role during primary peristalsis, helping in the return of the refluxed material to the stomach [9]. The masticatory function could play a role in the genesis of GERD, but studies are scarce. Swallowing poorly chewed food could force the stomach to prolong the process of grinding food [10], allowing for more reflux episodes to occur in the postprandial period. Inadequate mixing of saliva with food after insufficient

mastication could contribute to a more difficult esophageal transit, resulting in dysphagia.

In this study, we hypothesized that mastication might be associated with GERD. We also believe that poor chewing could predict the symptom dysphagia. Therefore, we executed a cross-sectional study in patients referred for elective investigation with upper GI endoscopy to address the association of mastication with GERD and mastication with esophageal dysphagia.

METHODS

STROBE (Strengthening the reporting of observational studies in epidemiology) Statement recommendations were followed in the design and reporting of this study [11].

Design, setting and participants

A cross-sectional study was performed in Passo Fundo (Brazil) between September 2020 and March 2021. Patients referred for elective upper GI endoscopy were recruited from two private clinics (Endopasso and EndoDiagnóstico, both in Passo Fundo). Participants were adult patients referred to investigate mainly dyspepsia and reflux symptoms. Exclusion criteria were surgical modifications of the upper GI tract, gastroesophageal neoplasia, and decompensated systemic illness. All participants signed an informed consent before entry into the study, which

followed the rules of the Helsinki declaration and was approved by the local Research Ethics Committee (number: 4.205.825).

Clinical examination and questionnaires

Clinical data and oral examination were assessed by a trained dentist (1st author) before the endoscopic examination. Clinical data included body mass index (BMI), medications, systemic diseases and history of abdominal surgery. Oral examination addressed the number and condition of teeth, presence and kind of dental prosthesis, facial pattern and dental occlusion.

Patients were instructed to answer questionnaires for assessment of chewing quality, xerostomia, and GERD symptoms. Chewing quality in the last two weeks was assessed with a questionnaire of French origin (Questionnaire D'Alimentation), translated to Brazilian Portuguese and cross-culturally adapted to Brazilian adolescents [12]. It consists of 26 questions with 5 possible answers (0 = no difficulty / 4 = maximal difficulty), distributed in 5 domains (food-chewing, habits, meat, fruits and vegetables), resulting in a final score ranging between 0 and 104, with a higher score indicating worst mastication.

Xerostomia was addressed with an inventory of 11 questions, translated and validated to Portuguese language [13] . The questions address symptoms of xerostomia in the last two weeks. Out of the

11 questions, we considered 5 questions with clear representativeness for xerostomia, as follows: 1. My mouth feels dry; 2. My lips feel dry; 4. My mouth feels dry when eating a meal; 5. I sip liquids to aid in swallowing food; and 11. I have difficulty eating dry food. Possible answers were never, hardly ever, occasionally, fairly often or very often. The final score ranges from 11 to 55, with higher scores implying greater severity of xerostomia. In the absence of an established cut-off for xerostomia (yes/no), we arbitrarily classified the presence of xerostomia when the answer was fairly often or very often in at least two of the five questions.

GERD symptoms were assessed and rated with a disease-specific questionnaire, translated and validated to Portuguese [14]. Heartburn was rated with the question "How bad is the heartburn?", whereas acid regurgitation was rated with the question "Do you feel returning gastric contents to the throat/mouth?". Dysphagia was assessed with the question "Do you have difficulty swallowing?" Each question was rated between 0 (no symptom) and 5 (incapacitating), with a score equal to or higher than 2 defining troublesome symptoms.

Upper GI endoscopy

Patients were examined by two experienced endoscopists, authors of the study, using the same protocols for the description

of endoscopic findings. After sedation with intravenous midazolam (0.05 mg/kg), the procedure was carried out using Olympus or Fujinon equipment for the description of any lesion in the esophagus, stomach and proximal duodenum. Reflux esophagitis was characterized according to Los Angeles classification. Hiatal hernia was identified when the gastric folds were 2 cm more above the diaphragmatic pinch. Esophageal biopsies were obtained for the suspicion of eosinophilic esophagitis.

Variables

Mastication was the main predictor, categorized as reduced versus regular/normal mastication. Firstly, the performance of mastication was classified into three levels (normal, regular and reduced) after evaluation with two instruments: i. A subjective evaluation of the mastication using the Questionnaire D'Alimentation [12], composed by 26 questions about chewing capacity, generating a final score ranging between 0 (normal chewing) and 104 (worst chewing). Considering that the highest score observed in our sample was 62 (most patients replied not applicable for a particular question concerning a vegetable that is not usually consumed), we arbitrarily decided to rate the levels 0 (score 0-20), 1 (21-40) and 2 (41-62); and ii. An objective assessment using oral examination executed by an experienced

dentist (1st author), who addressed the number and condition of teeth, presence and kind of dental prosthesis, facial pattern and dental occlusion, which resulted in levels 0 (ideal occlusion, either with natural teeth or adequate prosthetic rehabilitation), 1 (compromised occlusion by any change in occlusal balance), and 2 (severely compromised occlusion by poorly fitting prostheses, self-reporting of reduced mastication and tooth loss without rehabilitation). Reduced masticatory function was characterized when either subjective or objective assessments resulted in level 2. Regular mastication was assumed with level 1 in either assessment and normal mastication with level 0 in both subjective and objective assessments.

Xerostomia (yes/no) and other clinical characteristics [BMI (Kg/m^2), age (years), gender (male/female), smoking (yes/no), and use of proton pump inhibitors (PPIs, yes/no)] were considered in the analytical model as potential confounders.

GERD (yes/no) was defined in the presence of troublesome typical symptoms and/or reflux esophagitis grades B, C or D of Los Angeles, following the Lyon Consensus [5]. Dysphagia (yes/no) was identified when the corresponding question of the GERD symptom questionnaire scored 2 (troublesome dysphagia, not every day) or more.

Sample size and statistical analysis

A total sample size of 162 was estimated to detect a difference of 0.17 between prevalence in exposed and non-exposed groups, with 0.8 power, if the prevalence of the outcome in the non-exposed is 0.10, and 0.05 as the threshold for statistical significance.

Data are presented as mean ± standard deviation (SD) or frequencies (absolute and relative). Wilcoxon-Mann-Whitney and chi-square tests with exact p-values were applied for continuous and categorical data respectively, in the comparison between patients with poor mastication and regular/normal mastication.

The prevalence ratio (PR, and 95% confidence interval) was estimated using multivariate Poisson regression, with a robust estimator for the covariance matrix. Assumptions of adequate sample size, linearity of effect for quantitative variables and multicollinearity among confounders were checked to produce the final model. The inclusion of confounders was based on associations observed in the sample ($P < 0.30$) as well as conceptual frameworks using directed acyclic graphs (DAGs).

For the calculations, we used SPSS v.18 and DAGs were obtained with DAGitty package [15]. The alpha limit for the statistical significance was 0.050 in all tests, except in the modeling process.

RESULTS

Patients

A total of 179 patients agreed to participate. Eleven patients were excluded from the analysis: nine had gastroesophageal surgery, one presented esophageal neoplasia, and one had an incomplete endoscopic examination. Among 168 patients who were analyzed (Table 1), 46 had reduced masticatory function (27.4%), and 122 (72.6%) had regular/normal mastication. Poor chewing was indicated uniquely by dental examination in 24 patients, uniquely by the Questionnaire D'Alimentation in 6 patients, and by both instruments in 16 patients.

Patients with reduced mastication were approximately 10 years older than patients with regular/normal mastication, whereas the distribution of gender (a slight predominance of women) and BMI (overweight on average) did not differ between groups. Active smoking was found in a minority of patients in both groups (< 10%) and use of PPIs (regular or on-demand) was reported by half of the participants. Patients with reduced mastication presented a higher prevalence of xerostomia than patients with regular/normal mastication.

Table 1. Characteristics of the patients (n = 168) according to mastication status

	Reduced mastication (n = 46)	Regular/normal mastication (n = 122)	P-value
Age in years, mean ± SD	56.2 ± 14.3	47.4 ± 15.3	<0.001
Women, n (%)	25 (54.3)	74 (60.6)	0.458
BMI* in Kg/m^2, mean ± SD	26.8 ± 5.2	27.3 ± 5.2	0.594
Active smoking, n/total (%)	4/43 (9.3)	10/118 (8.5)	>0.999
Use of PPIs**, n/total (%)	26/45 (57.7)	63/118 (53.4)	0.725
Xerostomia, n (%)	17 (37.0)	22 (18.0)	0.014

*Body mass index; **Regular or on-demand.

Endoscopic findings

The most common endoscopic diagnosis was uncomplicated gastritis, combined or not with uncomplicated duodenitis (Table 2), described in approximately 60% of endoscopies. Entirely normal endoscopy was found in a third of patients, while reflux esophagitis (Los Angeles B, C and D) and active/healing peptic ulcer were described in a minority of the participants. Sliding hiatal hernia was identified in a third of patients with reduced mastication and in a quarter of those with regular/normal mastication. The distribution of these endoscopic findings was similar between patients with reduced masticatory function and

patients with regular/normal mastication. There was one case with suspected eosinophilic esophagitis (in the group of regular/normal mastication), presenting subtle mucosal rings in the distal esophagus, which was not confirmed after pathological examination. No case of Barrett's metaplasia was detected.

Table 2. Endoscopic findings (n = 168) according to mastication status

	Reduced mastication (n = 46)	Regular/normal mastication (n = 122)	P-value
Entirely normal	16 (34.7)	47 (38.5)	0.723†
Gastritis and/or duodenitis*	29 (63.0)	71 (58.2)	0.601
Sliding hiatal hernia	16 (34.7)	32 (26.2)	0.338
Reflux esophagitis B, C or D	5 (10.8)	10 (8.2)	0.558
Peptic ulcer**	1 (2.2)	5 (4.1)	>0.999

†Comparison between entirely normal endoscopy vs. abnormal (any endoscopic alteration); *No signs of obstructive lesions; **Active or healing ulcer in the stomach or duodenum.

Association between reduced masticatory function, GERD and esophageal dysphagia

Both crude and age adjusted PR showed that reduced mastication was associated with GERD manifested as typical symptoms and/or moderate to severe reflux esophagitis (Table 3).

The presence of reduced masticatory function increased the prevalence of GERD by 38%. Reduced mastication was also associated with esophageal dysphagia, which doubled in prevalence after controlling for age and xerostomia.

Table 3. Crude and adjusted measures of association between reduced mastication and GERD, and between reduced mastication and esophageal dysphagia (n = 168 patients).

Outcome	Univariable analysis		Multivariable analysis	
	P	Crude PR† (95% CI)	P	Ajusted PR† (95% CI)
GERD	0.040	1.25 (1.01-1.55)	0.003	1.38 (1.12-1.70)*
Dysphagia	0.004	2.65 (1.37-5.12)	0.002	2.03 (1.02-4.04)**

†Prevalence ratio; *Multivariable analysis adjusting for age (years); **Adjusting for age (years) and xerostomia (yes/no).

DISCUSSION

The mouth and the esophagus are linked by physiological and pathological conditions. For example, chewing capacity and salivary function are fundamental for the preparation and deglutition of food [16]. Saliva deglutition also helps in protecting the esophagus against refluxed gastric contents [9, 17]. On the other hand, chronic reflux in GERD patients can damage the teeth, provoking dental erosions [18], and can decrease the salivary secretion, contributing to xerostomia symptoms [19]. These and other evidence support the concept that the relationship between

the oral cavity and esophagus is bidirectional. In this study, we tested the hypothesis that reduced mastication can be a risk factor for GERD and also for esophageal dysphagia in patients referred for upper GI endoscopy.

The main findings of our study were: 1. Reduced masticatory function was associated with GERD, manifested by typical reflux symptoms and/or moderate to severe reflux esophagitis; 2. Esophageal dysphagia was also predicted by reduced mastication; 3. Reduced masticatory performance was frequent, affecting a quarter of patients investigated with upper GI endoscopy; and 4. Identification of masticatory dysfunction was feasible in the endoscopic practice, carried out by an experienced dentist, combining a detailed oral examination and a specific chewing questionnaire.

To our knowledge, this is the first study addressing the relationship between masticatory function and GERD. In patients referred for upper GI endoscopy, we observed that reduced mastication was associated with GERD, as compared to patients with regular/normal mastication. In this study, GERD was identified by the presence of typical symptoms and/or moderate to severe reflux esophagitis. As the assessment of masticatory function is not consensual [20], we applied objective and subjective instruments for the evaluation of chewing capacity, categorized as normal, regular and poor by an experienced dentist. Because

patients with mild masticatory dysfunction can adequately prepare the food for swallowing [21], we decided to join patients with normal and regular function, and separate patients with reduced chewing function for comparisons. To address confounding, we first considered age, gender, BMI, use of PPIs, xerostomia and smoking habit [22-24]. However, only age and xerostomia fulfilled the criteria we used to avoid excess of covariables, which might affect precision in the final model.

We acknowledge that a cross-sectional study may not be the best design to indicate causality between reduced mastication and GERD. Moreover, the swallowing of poorly ground food might prolong the time needed for the stomach to prepare the chyme [10]. It has been reported that dental treatment with resolution of masticatory dysfunction improves gastric emptying [25, 26]. Although controversial, delayed gastric emptying might favor the occurrence of reflux [27]. Further studies are needed to clarify the mechanisms of the relationship between reduced masticatory function and GERD.

In outpatients investigated with upper GI endoscopy, reduced masticatory performance doubled the risk of esophageal dysphagia as compared to patients with regular/normal mastication. Although not addressed in this study, the likely mechanism underlying such association is the prolongation of esophageal transit when swallowing poorly chewed food with a

smaller amount of saliva, a biological lubricant [23]. We had the caution to control for xerostomia, a potential confounder in the relationship between poor mastication and dysphagia [28]. Xerostomia and GERD have bidirectional relationships, with xerostomia acting as a risk factor for GERD due to decreased esophageal clearance, and GERD acting by decreasing salivary secretion [29]. Also important in the present study, dysphagia was assessed with a validated questionnaire developed to rate GERD symptoms. Further studies using dysphagia-specific instruments, such as the brief esophageal dysphagia questionnaire are warranted [30].

Reduced masticatory function was found in a substantial proportion (a quarter) of patients referred for upper GI endoscopy. In the ambient of endoscopic procedures, an experienced dentist was able to identify and classify masticatory dysfunction. An interdisciplinary approach with gastroenterologists and dentists might benefit patients with GERD and non-obstructive esophageal dysphagia after the management of oral conditions that can lead to reduced masticatory function. Clinical trials testing such hypothesis are desirable.

This study has some limitations. Although GERD was rated with a validated questionnaire and complemented with endoscopic evaluation, reflux testing such as esophageal pH

(±impedance) was not available for this study. An objective assessment of the esophageal transit is also lacking. However, we have strengthening, including sufficient sample size, a combined evaluation of the masticatory function with subjective and objective instruments, and the controlling for important confounders, particularly xerostomia. Finally, we believe that our results are well generalizable for patients who seek the GI practitioner because of acid-related disorders.

In conclusion, we addressed the relationship between masticatory performance, GERD and esophageal dysphagia. In outpatients referred for elective upper GI endoscopy, reduced masticatory function was associated with GERD and also with esophageal dysphagia, suggesting that reduced mastication, found in a quarter of the patients, may be a new risk factor for both GERD and dysphagia. Further studies are needed to evaluate the mechanisms underlying such associations, and whether the recovery of the chewing performance after dental treatment can benefit patients with GERD and esophageal dysphagia.

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ARTIGO II

Impaired masticatory function predicts postprandial distress syndrome in patients investigated with upper endoscopy[4]

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Abstract

Background: The pathophysiology of dyspepsia is not completely understood. Impaired mastication could force the stomach to do extra work in crushing food and therefore contribute to the genesis of dyspeptic symptoms. **Aim:** To assess the relationship between mastication and dyspepsia. **Methods:** In this cross-sectional study, 179 adult patients referred for elective upper digestive endoscopy accepted to participate. Before endoscopy, an expert dentist performed an oral examination and objectively scored chewing function in three levels (normal, regular and impaired), and applied questionnaires for assessment of dyspepsia (Rome IV), xerostomia and mastication (normal, regular and impaired). The impaired masticatory function was defined when either oral examination or mastication questionnaire rated the chewing function as poor. Associations between mastication, confounders and dyspepsia were calculated with Poisson regression [prevalence ratio (PR) (95% Confidence Interval)]. **Results**: Thirty-two patients were excluded due to relevant organic diseases in the upper gastrointestinal tract. Among 147 patients with non-organic diseases (aging 49.6 ± 15.8 years; 61.9% women), 40 (27.2%) had impaired mastication and 107 (72.8%) had regular/normal mastication. After adjusting for age and xerostomia, impaired mastication was associated with postprandial distress syndrome [PR = 1.84 (95%CI 1.19 –

2.85)but not with epigastric pain syndrome [PR = 0.98 (95%CI 0.64 – 1.50)]. **Conclusions**: In patients referred for upper digestive endoscopy, impaired masticatory function predicted postprandial distress syndrome but not epigastric pain syndrome. An interdisciplinary approach with physicians and dentists might be beneficial for dyspeptic patients with postprandial distress syndrome.

Keywords: Dyspepsia; Mastication; Postprandial distress syndrome; Xerostomia.

INTRODUCTION

Dyspepsia refers to epigastric symptoms, particularly pain, postprandial fullness and early satiety [1]. It affects approximately 20% of the worldwide population and is related to substantial costs and negative impact on quality of life [2, 3]. Most cases are known as functional dyspepsia, in which patients present with a chronic course of permanent or intermittent dyspeptic symptoms, in the absence of relevant organic disease [1]. Functional dyspepsia may be classified as postprandial distress syndrome (PDS) and epigastric pain syndrome (EPS). In less than 15% of cases, the symptoms can be secondary to an organic cause, like peptic ulcer, reflux esophagitis, and gastroesophageal tumors [4]. Such organic diseases are usually diagnosed by upper gastrointestinal (GI) endoscopy, which may also identify the gastric infection by *Helicobacter pylori* [5].

The pathophysiology of dyspepsia is complex and not fully understood [4]. Studies have demonstrated the presence of several mechanisms, either peripheral at the visceral level or centrally, in the nervous system [6]. In the absence of organic disease, dyspeptic symptoms can be mediated by an imbalance among upper GI dysmotility, visceral hypersensitivity, gut dysbiosis including *Helicobacter pylori* infection, increased gastroduodenal permeability, aggressive pharmacological agents, smoking and other unknown mechanisms [7-9]. The peripheral signaling of

dyspeptic symptoms through the brain-stomach axis may also be modulated centrally by emotions, such as anxiety and depression and by cognitive/memory impulses [10-12].

The crushing of swallowed food is a major task for the stomach. In normal conditions, this process is started in the mouth, with proper mastication [13, 14], which depends on the adequate functioning of several anatomical structures, including dental arches, tongue, saliva, jaw movements and oral sensitivity [15]. Subtle changes in mastication might be compensated by the selection of easier-to-chew foods and self-adaptation of oral structures, keeping swallowed food close to ideal [16]. Severe impairment of mastication could force the stomach to do extra work. We hypothesized that impaired mastication might be a risk factor for dyspeptic symptoms, particularly those related to postprandial distress syndrome. We, therefore, carried out a cross-sectional study in patients referred for elective upper GI endoscopy to assess the relationship between mastication and dyspepsia.

METHODS

STROBE (Strengthening the reporting of observational studies in epidemiology) Statement recommendations were followed in the design and reporting of this study [17].

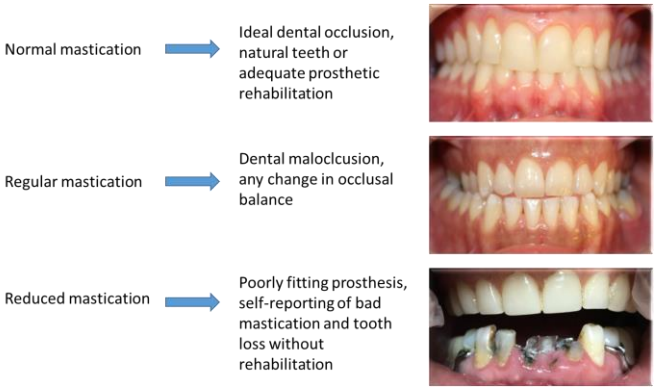
Design, setting and participants

A cross-sectional study was conducted in Passo Fundo (Brazil) between September 2020 and March 2021. Patients referred for elective upper digestive endoscopy were recruited from two private clinics (Endopasso and EndoDiagnóstico, both in Passo Fundo). Participants were adult patients referred to investigate mainly dyspepsia and reflux symptoms. Exclusion criteria were surgical modifications of the upper digestive tract, gastroesophageal neoplasia and decompensated systemic illness. All participants signed and informed consent before entry into the study, which followed the rules of the Helsinki declaration and was approved by the local Research Ethics Committee (number: 4.205.825).

Clinical examination and questionnaires

Clinical data and oral examination were obtained by a trained dentist (1st author) before the endoscopic examination. Clinical data included body mass index (BMI), medications, systemic diseases and history of abdominal surgery. Oral examination addressed the number and condition of teeth, presence and kind of dental prosthesis, facial pattern and dental occlusion (figure 1). Patients were instructed to reply to questionnaires for assessment of chewing quality, xerostomia, typical GERD symptoms and dyspepsia.

Figure 1. Objective assessment of the masticatory performance by dental examination. There are examples of patients with normal, regular and impaired masticatory function.



Chewing quality in the last two weeks was assessed with a questionnaire of French origin (Questionnaire D'Alimentation), translated to Brazilian Portuguese and cross-culturally adapted to Brazilian adolescents [18]. It consists of 26 questions with 5 possible answers (0 = no difficulty / 4 = maximal difficulty), distributed in 5 domains (food-chewing, habits, meat, fruits and vegetables), originating a final score ranging between 0 and 104, with a higher score indicating worst mastication.

Xerostomia was addressed with an inventory of 11 questions, translated and validated to Portuguese language [19]. The questions address symptoms of xerostomia in the last two weeks. Out of the 11 questions, we considered 5 questions with clear representativeness for xerostomia, as follows: 1. My mouth feels

dry; 2. My lips feel dry; 4. My mouth feels dry when eating a meal; 5. I sip liquids to aid in swallowing food; and 11. I have difficulty eating dry food. Possible answers were never, hardly ever, occasionally, fairly often, or very often. The final score ranges from 11 to 55, with higher scores implying greater severity of xerostomia. In the absence of an established cut-off for xerostomia (yes/no), we arbitrarily classified the presence of xerostomia when the answer was fairly often or very often in at least two of the five questions.

Dyspepsia and its subcategories (PDS and EPS) were evaluated with the Rome IV Diagnostic Questionnaire for Adults (R4DQ) [20]. It has high sensitivity and specificity for the diagnosis of functional dyspepsia and other functional gastrointestinal disorders. We considered the two questions about postprandial discomfort (fulness and early satiety, at least two or three days a week) and a question about epigastric pain (at least once a week). The license and authorization to use the questionnaire were paid for and granted through the Rome Foundation.

Upper digestive endoscopy

Patients were examined by two experienced endoscopists, authors of the study, using the same protocols for endoscopic findings. After sedation with intravenous midazolam (0.05 mg/kg), the procedure was done using Olympus or Fujinon, with

the characterization of any lesion in the esophagus, stomach and proximal duodenum. When requested by the referral physician, the presence of *Helicobacter pylori* in the gastric mucosa was searched by urease test (two fragments, from antrum and corpus) or pathological examination of biopsy specimens (two fragments from the antrum and two from corpus).

Variables

Mastication was the main predictor, categorized as impaired versus regular/normal mastication. Firstly, the performance of mastication was classified into three levels (normal, regular and poor) after evaluation with two instruments: i. A subjective evaluation of the mastication using the Questionnaire D'Alimentation [18], composed of 26 questions about chewing capacity, generating a final score ranging between 0 (normal chewing) and 104 (worst chewing). Considering that the highest score was 62 (most patients replied not applicable for a particular question concerning a vegetable that is not usually consumed), we arbitrarily decided to rate the levels 0 (score 0-20), 1 (21-40) and 2 (41-62); and ii. An objective assessment (Figure 1) by means of oral examination executed by an experienced dentist (1st author), addressing the number and condition of teeth, presence and kind of dental prosthesis, facial pattern, and dental occlusion originating the levels 0 (ideal

occlusion, either with natural teeth or adequate prosthetic rehabilitation), 1 (compromised occlusion by any change in occlusion balance), and 2 (severely compromised occlusion by poorly fitting prostheses, self-reporting of reduced mastication and tooth loss without rehabilitation). The impaired masticatory function was characterized when either subjective or objective assessments resulted in level 2. Regular mastication was assumed with level 1 in either assessment and normal mastication with level 0 in both subjective and objective assessments.

Dyspepsia and its categories (PDS and EPS) were firstly characterized using the R4DQ. After endoscopic evaluation, patients were classified as having relevant organic diseases (neoplasia, reflux esophagitis B, C and D of Los Angeles, and active/healing peptic ulcer), minor abnormalities (reflux esophagitis grade A, gastritis and duodenitis) and entirely normal endoscopy. The main outcome was functional dyspepsia, according to Rome IV criteria, in the absence of clinically significant endoscopic findings [1, 21]. Potential confounders were xerostomia (yes/no), BMI (kg/m^2), age (years), gender (male/female), smoking (yes/no), and use of PPIs (yes/no)]. The infection by *Helicobacter pylori* was described when available.

Sample size and statistical analysis

A sample size of 170 participants was estimated to detect a difference of 0.26 between prevalence in exposed and non-exposed groups, with 0.8 power, if the prevalence of the outcome in the non-exposed is 0.30, and 0.05 as the threshold for statistical significance.

Data are presented as mean ± standard deviation (SD) or frequencies (absolute and relative). Wilcoxon-Mann-Whitney and chi-square tests with exact p-values were applied for continuous and categorical data respectively, in the comparison between patients with impaired mastication and regular/normal mastication.

The prevalence ratio (and 95% confidence interval) was estimated using multivariate Poisson regression, with a robust estimator for the covariance matrix. Assumptions of adequate sample size, linearity of effect for quantitative variables and multicollinearity among confounders were checked to produce the final model. The inclusion of confounders was based on associations observed in the sample ($P < 0.30$) as well as conceptual frameworks using directed acyclic graphs (DAGs).

For the calculations, we used SPSS v.18 and DAGs were obtained with DAGitty package [22]. The alpha limit for the statistical significance was 0.050 in all tests, except in the modeling process.

RESULTS

Patients

A total of 179 patients agreed to participate. Thirty-two patients were excluded from the analysis: fifteen presented moderate to severe reflux esophagitis, nine had gastroesophageal surgery, six showed active/healing peptic ulcer, one presented esophageal neoplasia, and one had an incomplete endoscopic examination. Among 147 analyzed patients, 40 had impaired masticatory function (27.2%) and 107 (72.8%) had regular/normal mastication. Among 40 patients with impaired mastication, the masticatory status was identified by both dental examination and Questionnaire D'Alimentation in 14 patients, uniquely by dental examination in 21, and uniquely by the questionnaire in 5 patients.

Patients with impaired mastication were approximately ten years older than patients with regular/normal mastication (Table 1), whereas the distribution of gender (a slight predominance of women) and BMI (overweight on average) did not differ between the groups. Active smoking was found in a minority of patients in both groups (< 11%) and use of PPIs (regular or on-demand) was reported by a slight majority of participants, regardless of the mastication status.

The most common endoscopic diagnosis was uncomplicated gastritis/duodenitis, found in approximately 60%

of endoscopies. Unrevealing endoscopy was found in a third of patients, while mild reflux esophagitis was described in less than 15% of the participants. The distribution of the endoscopic findings did not differ significantly between patients with impaired mastication and patients with regular/normal mastication.

Among 147 participants, 51 underwent gastric biopsies for investigation of *Helicobacter pylori*. The prevalence of *Helicobacter pylori* infection did not differ between patients with impaired mastication and regular/normal mastication (31% vs. 24%; P = 0.716).

Table 1. Characteristics of the patients (n = 147) according to mastication status

	Impaired mastication (n = 40)	Regular/normal mastication (n = 107)	P-value
Age in years, mean ± SD	57.0 ± 14.8	46.8 ± 15.4	<0.001
Women, n (%)	24 (60.0)	67 (62.6)	0.771
BMI* in Kg/m^2, mean ± SD	26.2 ± 5.0	27.0 ± 5.2	0.472
Active smoking, n/total (%)	4/37 (10.8)	8/104 (7.7)	0.740
Use of PPIs**, n/total (%)	25/39 (64.1)	56/104 (53.8)	0.344
Endoscopic findings, n (%)			0.855
Normal endoscopy	13 (32.5)	40 (37.4)	
Grade A reflux esophagitis	5 (12.5) †	12 (11.2) ††	
Gastritis/duodenitis	24 (60.0)	60 (56.1)	
HP# infection, n/total (%)	13/4 (31)	38/9 (24)	0.716

*Body mass index; **Regular or on demand; †Two patients had combined gastritis; ††Ten patients had combined gastritis; #*Helicobacter pylori.*

Association between impaired masticatory function and dyspepsia

In the univariate analyses (Table 2), impaired mastication was associated with PDS, but not with EPS. After the inclusion of age and xerostomia as the confounders in the multivariable analysis, impaired mastication presented a stronger association

with PDS (PR = 1.84) and no association with EPS (PR = 0.98). When combining patients with PDS and EPS (overall dyspepsia), no association was observed with impaired mastication [adjusted PR = 1.18 (95% CI 0.87 – 1.61); P = 0.293].

Table 2. Crude and adjusted measures of association between impaired mastication and postprandial distress syndrome (PDS), and impaired mastication and epigastric pain syndrome (EPS). Gender and xerostomia were the confounders included in the multivariable model.

Outcome	Univariable analysis		Multivariable analysis	
	P	Crude PR† (95% CI)	P	Adjusted PR† (95% CI)
PDS*	0.028	1.56 (1.05-2.32)	0.006	1.84 (1.19-2.85)
EPS**	0.907	1.02 (0.68-1.53)	0.914	0.98 (0.64-1.50)

†Prevalence ratio; *Postprandial distress syndrome; **Epigastric pain syndrome.

DISCUSSION

To date, most studies on the pathophysiology of dyspepsia have focused on visceral mechanisms, including gastroduodenal sensitivity and motility, gut dysbiosis and brain-gut axis disruption [6]. The process of food crushing is a complementary function of the stomach, which handles the bolus partially prepared in the oral cavity through masticatory activity [23]. It seems logical that poorly chewed food will result in extra work

for the stomach since the release of chyme into the small intestine is a condition highly controlled by the pylorus [24]. Theoretically, such gastric extra work might result in symptoms perception in patients who seek medical consultation because of upper GI complaints. It has been demonstrated that dental rehabilitation of implant-supported prosthesis and orthodontic treatment for correction of malocclusion improves gastric emptying [25, 26]. We, therefore, accessed the relationship between mastication and dyspeptic symptoms.

In adult patients referred for elective upper GI endoscopy, we found that: 1. Severe compromising of masticatory function, named here impaired mastication, was prevalent, affecting approximately a quarter of the participants; 2. Impaired mastication, in comparison to regular/normal mastication, was associated with postprandial distress syndrome; and 3. In contrast, impaired mastication did not predict epigastric pain syndrome.

The impaired masticatory function was identified in a quarter of patients referred for elective upper endoscopy. Chewing ability can be compromised by several factors, including loss of dental elements [25] and malocclusion [26]. Furthermore, edentulism is still highly prevalent, particularly in elderly patients, often treated with inadequate prostheses [27]. Older patients may also present systemic diseases associated with the use of polypharmacy, which can cause negative effects on the

teeth, oral mucosa and masticatory muscles [27]. In the present study, patients with impaired mastication were older than those with regular/normal mastication.

To our knowledge, this is the first study addressing the relationship between masticatory function and dyspepsia. The risk of postprandial distress syndrome was 84% (PR = 1.84) higher in patients with impaired mastication than patients with regular/normal masticatory function. Postprandial distress syndrome is the main subtype of functional dyspepsia, in which patients complain of postprandial fullness and/or early satiety [28]. A likely mechanism for such association is the extra effort that the stomach needs to make after the ingestion of badly chewed food since gastric emptying for the small bowel is quite demanding in terms of chyme preparation [23]. Di Stefano and Colleagues demonstrated in healthy volunteers that masticatory alterations could be responsible for dyspeptic symptoms, suggesting that insufficient chewing induces a more complex intraluminal bolus management at gastric fundus level [29]. Studies in dyspeptic patients are needed to understand the dynamics between masticatory patterns and gastric function, considering the type of food, mealtime, salivary action, gastric distension, perception of dyspeptic symptoms and gastric emptying.

Despite its association with postprandial distress syndrome, impaired mastication did not predict the subtype of dyspepsia

characterized by epigastric pain. It is unknown why some dyspeptic patients perceive only epigastric pain/burning while others report postprandial fulness or even mixed dyspeptic symptoms [4]. Studies indicate that patients with epigastric pain syndrome present gastric changes characterized by chemical and mechanical hypersensitivity [9, 30]. The specific association between impaired mastication and postprandial dyspepsia may be a differentiating factor between the two main subtypes of dyspepsia.

In clinical practice, the evaluation of masticatory function is difficult to perform and therefore is often overlooked. We have the caution to combine two instruments for identification impaired masticatory function, i.e., a subjective assessment with a validated questionnaire [18], and an objective oral evaluation performed by an experienced dentist. However, most of our patients with bad mastication (87%) were identified as such by the objective assessment, highlighting the importance of a specialized dental examination of GI patients. In clinical practice, an interdisciplinary approach between physicians and dentists has been already practiced for patients with GERD and dental erosions [31]. Additional medical and dental studies are needed to establish a valid and feasible approach to identify masticatory dysfunction and its medical consequences.

This study has limitations. Although impaired mastication was characterized using two instruments, we did not apply devices to measure the size of food particles when chewed, being able to assess the crushing of food before swallowing [32]. Furthermore, data about *Helicobacter pylori* infection was available for a minority of patients, precluding its inclusion as a confounder in the statistical model. Moreover, we present an adequate sample size and we used the Rome IV criteria [1] for proper recognition and classification of dyspeptic patients.

In conclusion, we assessed the relationship between mastication and dyspepsia in outpatients referred for elective upper endoscopy. We found that severe compromising of the masticatory function, present in a quarter of these patients, was associated with postprandial distress syndrome, the most common subtype of functional dyspepsia. Physicians and dentists working together might benefit dyspeptic patients by identifying and improving masticatory function. Clinical trials are needed to confirm such benefits.

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CONSIDERAÇÕES FINAIS

Na presente tese pesquisou-se a associação entre a função mastigatória e as manifestações esofagogástricas benignas como DRGE, disfagia esofágica e dispepsia. A função mastigatória foi avaliada de forma robusta, combinando os resultados de um questionário específico, validado para o Português, com o exame oral minucioso realizado por uma dentista.

Os achados foram bastante interessantes: pacientes com função mastigatória reduzida apresentaram índices maiores de DRGE, disfagia esofágica e dispepsia do tipo desconforto pós-prandial. Como essas são doenças bastante prevalentes na prática da gastroenterologia, a associação delas com a função mastigatória abre uma avenida para pesquisas e para abordagens clínicas futuras, desde que mais estudos esclareçam os mecanismos subjacentes à estas associações. Também são necessários ensaios clínicos para demonstrar o potencial benefício que pacientes submetidos a reabilitação da função mastigatória

poderão apresentar benefícios quanto a sintomas de DRGE e dispepsia.

Assim, o presente estudo apresenta importância na prática clínica, tanto para o cirurgião-dentista quanto para o médico gastroenterologista, visto que há uma relação entre cavidade oral, esôfago e estômago, podendo levar essas especialidades clínicas a fazerem um trabalho multidisciplinar e beneficiar os pacientes que apresentam tais manifestações (DRGE, disfagia esofágica e dispepsia).

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