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Effect of Lozenges on Voice Related Acoustic Parameters

Dr. Sadia M Shaikh[1], Jacqueline B Fernandes[2], Dr. Kuldeep Moras[3]

[1]PG Resident, Department of ENT, Father Muller Medical College Hospital, Kankanady Mangalore, Karnataka, India

[2]Assistant Professor, Department of Audiology & Speech Language Pathology, Father Muller College of Speech and Hearing (Mangalore University), Kankanady Mangalore, Karnataka, India

[3]Professor, Department of ENT, Father Muller Medical College Hospital, Kankanady Mangalore, Karnataka, India

Abstract: ***Introduction: Lozenges are often taken as off the counter or based on the physician's instructions. It is usually taken to facilitate a soothing effect on the vocal tract due to irritation or discomfort caused at the level of the oropharynx during upper respiratory tract infections. Aim: The purpose of this study was to investigate the effects of lozenges on vocal tract by assessing the voice related acoustic parameters. Material and Method: A total of 60 patients were included in the study. The Acoustic parameters were obtained using Dr. Speech before consuming a lozenge and 30 minutes after consumption of a lozenge. The parameters assessed were Frequency (F0), Jitter, Shimmer, and Harmonics to Noise Ratio (HNR). Results: Significant differences were seen in HNR of the affected population.***

Keywords: Lozenges**,** acoustic parameters, harmonics to noise ratio, jitter, shimmer

1. Introduction

Lozenges as a whole are formulated in a way that the lozenge produces an anaesthetic when sucked on, which stops the pain of a sore throat. That is the extent of their effect on the vocal tract. They are medicated in that they contain an anaesthetic, but they are not medicated to fix the sore throat symptoms. They make your throat feel better for a while, but they do not fix the problem. Licorice and Marshmallow that are components in most candies and sweets have been used as a base in most commercially available lozenges and are reported to have a soothing and numbness affect on the vocal musculature.

When the voice has been numbed by anaesthetic, one cannot feel what one is doing to their voice. This in turn can lead to vocal nodules or other vocally abusive conditions.

If one uses their vocal cords when their throat has been numbed, one could end up bursting a blood vessel in the vocal tract, known as a vocal haemorrhage, through simply straining their voice, in a way that their voice isn't used to.

Studies have also reported the use of lozenges post operatively in order to rid patients off the post intubation vocal mechanism secretions. The use though reported has been usually advised as a temporary relief based source.

A study carried out by Gupta et. al. , reports strepsils lozenges to be effective in decreasing sore throat symptoms in smokers.

2. Review of Literature

1) McHardy FE, Chung F: **Postoperative sore throat: cause, prevention and treatment**. *Anaesthesia*; 1999, 54: 444-53.

The study included 1232 patients from 15 studies; 672 patients were given topical or systemic lidocaine therapy and 560 patients were allocated to the control group. It was observed that both the topical and systemic lidocaine therapy significantly reduced the risk of postoperative sore throat (risk ratio (RR) 0.58; 95% confidence interval (CI) 0.41 to 0.82). Furthermore, to evaluate the severity of sore throat on a visual analogue scale (VAS), 219 patients were given topical or systemic lidocaine therapy and 152 patients were allocated to the control groups. The result showed that severity of sore throat was reduced (mean difference (MD) -11.9; 95% CI -16.44 to -7.32), an effect that neared statistical significance.

Also, the adverse effects of lidocaine were not reported in these studies. Their systematic review establishes the effectiveness of topical and systemic lidocaine for the prevention of postoperative sore throat resulting from intubation. The risk and severity of postoperative sore throat tended to be reduced. The effect size of lidocaine appeared to be affected by drug concentration and route of administration; management of cuff pressure during anaesthesia; the included population; and the type of outcome measured.

2) **Strepsils Tablets Reduce Sore Throat and Hoarseness After Tracheal Intubation**. Ebneshahidi A, MD and Mohseni M, MD. *Anesthesian Analgous*; 2010, 111:892-4.

The study consisted of one hundred fifty patients, ASA physical status I to II were scheduled to undergo general anesthesia and elective orthopedic or gynecologic surgery were enrolled. Participants were randomly allocated to receive either Strepsils or identical-looking placebo tablets immediately before arrival to the operating room. The incidence and severity of postoperative sore throat and

hoarseness were evaluated immediately and 24 hours after surgery.

The incidence of early postoperative sore throat was 13.7% and 33.3% and hoarseness was 12.3% and 26.4% in the Strepsils and placebo groups, respectively ($P < 0.05$). After one day of surgery, the incidence of sore throat decreased to 6.8% and 18.1% in the Strepsils and control groups, respectively. The incidence of hoarseness 1 day after the operation decreased to 8.2% in the Strepsils group and 19.4% in the placebo group, but the difference remained statistically significant ($P < 0.05$).

The study concluded that peri-operative use of Strepsils tablets reduces postoperative sore throat and hoarseness of voice.

3) Stride PC: Postoperative sore throat: topical hydrocortisone. *Anaesthesia*; 1990, 45:968-71.

The study was based on the notion that dexamethasone may have potential advantages in the prevention of postoperative sore throat. The authors therefore undertook a study to evaluate the efficacy of intravenously administered dexamethasone in reducing the incidence and severity of postoperative sore throat in patients receiving general anaesthesia with endotracheal intubation.

The method used was a randomized, double-blind and placebo-controlled study, in which 120 patients received general anaesthesia with endotracheal intubation and were randomly assigned to two groups. Group 1 (control) patients received normal saline 2 mL iv and group 2 (D) patients received dexamethasone 8 mg iv. After surgery, visual analogue scale (VAS) scores at rest and with effort (swallowing movement) for postoperative sore throat were recorded by a blinded observer.

The results showed that the overall incidence of postoperative sore throat during the first 24 hr following surgery was lower in dexamethasone group (D) compared to the control group (C). Eleven (20%) patients in the dexamethasone group had postoperative sore throat, compared to 31 (56.3%) patients in the control group ($P < 0.01$). Postoperatively at one hour, three hours, six hours, 12 hr and 24 hr, the VAS scores for postoperative sore throat at rest and during effort were lower in the dexamethasone group (D) compared to the control group ($P < 0.01$) at corresponding time intervals.

Thus it was concluded that preoperative administration of dexamethasone 8 mg iv reduces the incidence and severity of postoperative sore throat in patients receiving general anaesthesia with endotracheal intubation.

4) Aly AM, Al-Alousi L, Salem HA: **Licorice: a possible anti-inflammatory and anti-ulcer drug**. *AAPS Pharm Sci Tech*; 2005, 6:74-82.

The purpose of this investigation was to study the anti-inflammatory activities of both glycerrhitinic acid (GA) and the aqueous licorice extract (ALE) in comparison with diclofenac sodium (DS) (10 mg/kg), using the carrageenan-induced paw edema model in male albino rats. In addition, the anti-ulcer activities of ALE, famotidine (FT), and a combination of ALE and FT using indomethacin-induced ulceration technique in rat stomach were investigated. Conventional DS tablets containing GA, as well as DS chewable tablets containing either GA or ALE with different tastes were prepared. Also, rapidly disintegrating FT tablets were prepared using direct compression and camphor sublimation methods. ALE or GA produced significant anti-inflammatory activity similar to DS, and when taken concomitantly, there was no possible antagonism. The anti-ulcer activity of licorice was found to be similar to that of FT in indomethacin-induced ulceration technique in rat stomach. Combination therapy of both FT and licorice showed higher anti-ulcer activity than either of them alone. Generally, tablets containing the cross-linked sodium carboxymethyl cellulose (AcDisol) showed more rapidly disintegrating effect than those including Sodium starch glycolate (Primojel). The oral disintegration was very rapid for all the tested formulations. Also, the amount of FT absorbed from the oral cavity was nearly 9 from 10 mg theoretically present in each formula. It could be concluded that both GA and ALE have anti-inflammatory activity comparable with DS. It may be recommended to add ALE to either FT or diclofenac for more effective anti-inflammatory or anti-ulcer formulations, respectively.

5) Divya Gupta, Sanjay Agarwal, Jagdish. P.S. **Evaluation of the effect of strepsils lozenges on sore throat symptoms in smokers.** *Saudi Journal of Anaesthesia, 2014 Apr-Jun; 8(2): 244–248.*

The purpose of this study was to test the use of Strepsils lozenges in providing efficacy for decreasing Post Operative Sore Throat in smokers presenting for surgery under general anaesthesia with endotracheal intubation.

It included 100 patients of 20-65 years, American Society of Anaesthesiologists (ASA) physical status I and II, either sex who had history of smoking and was posted for elective surgical procedure of more than 1 hour, requiring general anaesthesia with endotracheal intubation and randomly divided into groups ($n = 50$) to receive Strepsils (Group A) and sugar candy (Group B). The patients were assessed for cough, sore throat, and hoarseness of voice after extubation, 30 min, 12 hrs, and 24 hrs after extubation.

At extubation no cough was seen in 39 (78%) patients (group A) compared to 23 (46%) patients (Group B), and mild cough in 22% (Group A) and 52% (Group B).

The results showed that the incidence of sore throat at extubation was lower in group A compared to Group B ($P = 0.04$). At other times of observations (30 min, 12 hrs and 24 hrs) there was a significant decrease in incidence of sore throat in Group A compared to Group B ($P = 0.000$). Hoarseness of voice was not observed in any patient in either group.

Thus it was concluded that the use of preoperative Strepsils lozenges decreases incidence of POST and maybe utilized as a simple and cost-effective measure for decreasing the symptoms of POST and increasing the satisfaction of patients.

3. Materials and Methods

This observational cross-sectional study was conducted between January 2017 to June 2017 at Father Muller Medical College Hospital. After approval from the Institutional Ethical clearance committee, we obtained informed consent for all patients. Out of 60 subjects, 30 patients reported an acute Upper Respiratory Tract Infection and were prescribed merely antibiotics who included in the study. 30 subjects who had no vocal complaints and possessed well-functioning, healthy vocal mechanism were taken. Any subject who underwent surgery of the pharynx or larynx, or who are under the consumption of alcohol and tobacco products were excluded from the study. The diagnosis was always based on patient history and formal voice evaluation.

The assessment of vocal parameters was performed using the software called Dr. Speech. All patients were asked to suck (and not chew) the lozenges as per group allotment, 30 minutes prior to recording voice sample. A baseline assessment was recorded before receiving the lozenge. Subjects were asked to sustain the emission of |a| for at least 5 seconds at a comfortable level.

Sampling was done using purposive method. Results were presented as mean ± standard deviation (SD) for parametric data and as percentage (%) for non-parametric data. Analysis of variance (ANOVA) was used to analyze the continuous data. Mann - Whitney test was applied to compare the independent groups considering mean of sum of ranks. p value of < 0.05 was considered significant.

Group 1: X'_1 = Mean ± S.D.
Group 2: X'_2 = Mean ± S.D.
(For all the parameters being assessed)

$$\eta = \frac{2(Z_\alpha + Z_\beta)^2 \sigma^2}{(X'_1 - X'_2)^2}$$ Where,
Z_α = 1.96 at 95% C.I
Z_β = 0.841 at 80% Power

4. Results

A total of 60 subjects were enrolled in the study, including 30 case group and 30 control group each group having 15 male and 15 female subjects of 18 to 30 years of age. All the subjects successfully completed a pre and post evaluation and results were statistically analyzed.

Both the case and control group posed a significant difference in the Jitter, Shimmer and HNR values, but there was no much difference in F0.

Case Group

SUB NO	Gender	F0 Ad M – 80 – 120 Hz Ad F – 180 – 240 Hz	Post F0 Ad M – 80 – 120 Hz Ad F – 180 – 240 Hz	JITT 1.040%	Post JITT 1.040%	SHIM 3.810%	Post SHIM 3.810%	HNR 20 - 40 NL, <20 abnl,	Post HNR 20 - 40 NL, <20 abnl,
1	F	314.886	336.19	1.58	1.78	2.404	2.424	14	16
2	F	103.407	287.43	2.84	2.94	3.67	3.67	11	9
3	F	296.7	323.64	1.087	1.387	3.93	3.93	13	11
4	F	296	304.01	1.94	1.94	4.76	4.76	13	15
5	F	293.973	324.91	1.78	1.78	4.18	4.18	19	17
6	F	314.223	346.18	2.3	2.53	3.709	3.709	16	14
7	F	295.7	322.15	2.34	2.134	3.413	3.41	18	19
8	F	316.4	328.57	1.877	1.977	4.228	4.22	16	14
9	F	197.96	253.64	2.18	2.118	2.672	2.6	12	14
10	F	298.45	322.32	2.66	2.266	3.362	3.32	12	15
11	F	229.57	287.92	1.9	1.239	3.941	3.94	15	13
12	F	118.412	224.12	2.462	2.562	3.782	3.78	10	12
13	F	108.42	207.1	2.21	2.201	4.554	4.554	10	13
14	F	297.657	314.96	1.869	1.669	4.024	4.02	12	14
15	F	190.26	201.88	2.14	2.104	3.728	3.72	15	16
16	M	112.42	128.69	1.88	1.880	3.314	3.31	15	18
17	M	283.26	203.66	1.18	1.108	4.851	4.85	10	12
18	M	293.51	220.71	2.18	2.184	3.736	3.736	13	15
19	M	286.06	230.58	2.38	2.318	3.831	3.83	12	13
20	M	285.143	208.54	1.89	1.189	3.728	3.72	16	14
21	M	338.389	213.36	1.5	1.235	3.749	3.79	10	16
22	M	313.3	202.69	2.79	2.579	4.602	4.02	11	13
23	M	299.96	218.05	2.62	2.462	3.847	3.87	15	13
24	M	231.65	202.1	1.36	1.236	4.225	4.22	10	15
25	M	316.574	199.56	2.59	2.459	3.952	3.95	10	17
26	M	315.252	227.07	2.07	2.207	3.541	3.51	14	13
27	M	282.98	203.08	1.46	1.646	3.729	3.72	17	15
28	M	134.107	189.97	2.14	2.714	4.893	4.89	13	12
29	M	310.224	221.97	1.85	1.835	4.252	4.25	13	14
30	M	302.122	224.1	1.34	1.234	3.146	3.1	14	15

Control Group

Sub No	Gender	F0 Ad M – 80 – 120 Hz Ad F – 180 – 240 Hz	Post F0 Ad M – 80 – 120 Hz Ad F – 180 – 240 Hz	Jitt 1.040%	Post Jitt 1.040%	Shim 3.810%	Post Shim 3.810%	Hnr 20 - 40 Nl, <20 Abnl,	Post Hnr 20 - 40 Nl, <20 Abnl,
1	F	237.59	247.59	0.811	1.58	0.488	2.424	22	14
2	F	186.93	256.93	0.986	2.84	2.547	3.67	33	11
3	F	222.39	222.39	0.367	1.087	2.423	3.93	23	13
4	F	240.32	240.32	0.053	1.94	1.151	4.76	31	13
5	F	188.67	188.67	0.232	1.78	1.869	4.18	29	19
6	F	187.41	187.41	0.421	2.3	2.879	3.709	36	16
7	F	193.23	193.23	0.695	2.34	1.937	3.41	28	18
8	F	230.56	230.56	0.252	1.877	1.096	4.22	36	16
9	F	219.98	219.98	0.244	2.18	3.105	2.6	32	12
10	F	222.9	202.9	0.407	2.66	3.641	3.32	22	12
11	F	234.55	234.55	0.615	1.9	2.717	3.94	35	15
12	F	178.54	178.54	0.98	2.462	2.908	3.78	20	10
13	F	226.67	226.67	0.985	2.21	3.663	4.554	40	10
14	F	184.77	184.77	0.924	1.869	3.094	4.02	32	12
15	F	232.63	232.63	0.215	2.14	1.526	3.72	25	15
16	M	102.65	102.65	0.772	1.88	1.579	3.31	35	15
17	M	108.11	108.11	0.473	1.18	2.699	4.85	20	10
18	M	91.03	119.03	0.296	2.18	1.059	3.736	33	13
19	M	116.93	116.93	0.456	2.38	2.122	3.83	22	12
20	M	104.14	104.14	0.191	1.89	1.668	3.72	36	16
21	M	112.3	112.3	0.12	1.5	1.642	3.79	30	10
22	M	92.35	92.35	0.873	2.79	2.399	4.02	31	11
23	M	88.54	88.54	0.266	2.62	1.35	3.87	35	15
24	M	98.63	98.63	0.228	1.36	2.388	4.22	30	10
25	M	115.43	115.43	0.494	2.59	2.905	3.95	40	10
26	M	116.51	116.51	0.871	2.07	0.636	3.51	34	14
27	M	105.48	105.48	0.068	1.46	1.197	3.72	27	17
28	M	103.89	103.89	0.844	2.14	2.669	4.89	23	13
29	M	114.08	104.08	0.68	1.85	2.404	4.25	33	13
30	M	117.59	117.59	0.811	1.34	0.488	3.1	34	14

*'*p'* value is significant if above 0.05.

Correlation between Parameters

Correlation between Case & Control Groups

Variable	Group	MEAN	S.D.	'*t*' Score	'*p*' Value
F0	Case	9.9273	75.32553	.895	.375
	Control	-2.6000	14.48090	.895	.378
JITTER	Case	.0494	.25505	15.499	.000
	Control	-1.4922	.48137	15.499	.000
SHIMMER	Case	.0250	.10715	10.594	.000
	Control	-1.7585	.91582	10.594	.000
HNR	Case	-.9333	2.53164	14.871	.000
	Control	16.9333	6.07387	14.871	.000

'p' value is significant if above 0.05

5. Discussion

Our study demonstrated that there is a positive effect of lozenges on voice related acoustic parameters. The effectiveness of the lozenge lies in the dosage, formulation and time of administration. Studies derived that sore throat symptoms were reduced with the use of Strepsils lozenge, using subjective assessments of the symptomology while the majority of the other studies have utilized VAS as the tool for measuring the symptoms. To our knowledge, our study is probably the only study where effectiveness of lozenges was accounted by the effect on voice related acoustic parameters.

Patient related factors such as female sex, younger age groups, all predispose to sore throat symptoms.

Upper respiratory tract infection (URI) represents the most common acute illness evaluated in the outpatient setting. Upper Respiratory Tract Infections range from the common cold- typically a mild, self-limited, catarrhal syndrome of the nasopharynx- to life-threatening illnesses such as epiglottitis. The vocal cords are two bands of elastic muscle tissue. They are located side by side in the voice box (larynx) just above the windpipe (trachea). Like other tissues in the body, vocal cords can be strained and damaged. Vocal cords are also subject to infections, tumors and trauma. Certain infections- such as acute URTI can cause changes to the membranes and tissues of vocal fold that lead to change in voice of the individual.

Our study included case group consisting of 30 individuals who were diagnosed with acute URTI and a group of 30 individuals who had healthy and well functioning vocal tract. Instrumental analysis was done using Dr. Speech software that provides you with the ability to analyze and display acoustic and EGG features of a sustained vowel. A wide range of parameters (jitter, shimmer, NNE, etc.) and graphic displays (spectrogram, F0, intensity, etc.) can be obtained as well. Comparison can be made with a normative data base of 2973 normal voice and 902 pathological voices to determine if the current recording falls within normal limit on each of

the acoustic parameters. Based on that comparison, preliminary voice quality estimates are made of hoarseness, harshness and breathiness.

In our study, we focused on four parameters of voice, Fundamental frequency *f0*, Jitter, Shimmer, and Harmonics to Noise Ratio. The fundamental frequency is a measure of how high or low the frequency of a person's voice sounds. Its psychological correlate is pitch. It is the frequency of vocal fold vibration and correlates with changes in vocal fold tension and sub glottal air pressure. Amplitude perturbation or vocal shimmer serves as an index of vocal stability. Excessive shimmer= perception of hoarseness. A mean cycle-to-cycle amplitude difference of 0.7 dB or less variation or less than 7% of mean amplitude is normal. A harmonic object represents the degree of acoustic periodicity, also called Harmonics-to-Noise Ratio (HNR). In determining voice quality, a healthy speaker can produce a sustained [a] or [i] with a harmonicity of around 20 dB, and an [u] at around 40 dB; the difference comes from the high frequencies in [a] and [i], versus low frequencies in [u], resulting in a much higher sensitivity of HNR to jitter in [a] and [i] than in [u].

Both the groups posed a significant difference in the vocal parameters such as Jitter, Shimmer and Harmonics to Noise ratio (HNR).

6. Conclusion

The use of one licorice lozenge can have positive effects on voice. This low dose serves as an effective, cost limited and ready to use method that improve the quality of voice as seen by the change in values of vocal parameters.

References

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