



www.bioinformation.net
Volume 22(7)



Research Article

Received July 1, 2026; Revised July 31, 2026; Accepted July 31, 2026, Published July 31, 2026

DOI: 10.6026/973206300224499

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478

2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

Declaration on Publication Ethics:

The author's state that they adhere with COPE guidelines on publishing ethics as described elsewhere at <https://publicationethics.org/>. The authors also undertake that they are not associated with any other third party (governmental or non-governmental agencies) linking with any form of unethical issues connecting to this publication. The authors also declare that they are not withholding any information that is misleading to the publisher in regard to this article.

Declaration on official E-mail:

The corresponding author declares that lifetime official e-mail from their institution is not available for all authors

License statement:

This is an Open Access article which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. This is distributed under the terms of the Creative Commons Attribution License

Comments from readers:

Articles published in BIOINFORMATION are open for relevant post publication comments and criticisms, which will be published immediately linking to the original article without open access charges. Comments should be concise, coherent and critical in less than 1000 words.

Disclaimer:

Bioinformation provides a platform for scholarly communication of data and information to create knowledge in the Biological/Biomedical domain after adequate peer/editorial reviews and editing entertaining revisions where required. The views and opinions expressed are those of the author(s) and do not reflect the views or opinions of Bioinformation and (or) its publisher Biomedical Informatics. Biomedical Informatics remains neutral and allows authors to specify their address and affiliation details including territory where required.

Edited by Vini Mehta

E-mail: vmehta@statsense.in

Citation: Akote *et al.* Bioinformation 22(7): 4499-4504 (2026)

Comparative evaluation of stress ball distraction, binaural audio distraction and writing in the air using leg (WITAU) in gagging and anxiety management among children during dental treatment

Mrunalini Akote*, Shilpy Dwivedi, Vinod Patel, Gauri Patil, Aradhana Behera & Nitu Singh

¹Department of Pedodontics and Preventive Dentistry, New Horizon Dental College and Research Institute, Sakri, Bilaspur, Chhattisgarh, India; *Corresponding author

Affiliation URL:<https://www.nhdcricri.in/>**Author contact:**

Mrunalini Akote - E-mail: mrunaliniakote7@gmail.com; Phone: +91 9226041033

Shilpy Dwivedi - E-mail: dr.shilpy13@gmail.com; Phone: +91 9752366300

Vinod Patel - E-mail: dr.vinod2812@gmail.com; Phone: +91 7999793373

Gauri Patil - E-mail: pgauri271@gmail.com; Phone: +91 8308734825

Aradhana Behera - E-mail: aradhana.behera1997@gmail.com; Phone: +91 9438373890

Nitu Singh - E-mail: drnitusinghchauhan@gmail.com; Phone: +91 9174499994

Abstract:

Pediatric dental impressions often trigger gag reflex and anxiety, yet simple distraction techniques have not been sufficiently compared in children. Therefore, it is of interest to evaluate the 93 children randomized into three groups: stress ball distraction, binaural audio distraction and Writing in the Air Using Leg (WITAUL) during alginate impression procedures. Gagging severity and anxiety were assessed with standardized clinical indices during treatment. Binaural audio distraction proved most effective in reducing gag reflex and anxiety, while stress ball and WITAUL also produced significant improvement. Thus, data shows that all three techniques are practical, non-invasive and cost-effective options for improving child co-operation during dental impressions.

Keywords: Gag reflex, pediatric dentistry, distraction techniques, binaural audio, stress ball, writing in the air using leg (WITAUL), anxiety management

Background:

Gag reflex is a physiological process that helps to avoid the entry of foreign objects into the airway; nevertheless, in dental practice, especially in pediatric patients, it can pose a serious clinical problem. The hyperirritable gag reflex may disrupt normal dental practices like impression making, radiography and restorative interventions, thus affecting the quality of treatment and patient co-operation [1, 2]. Psychological factors like fear, anxiety and unfamiliarity with dental procedures also increase the gag reflex in children [3]. Gag reflex is a multifactorial process that entails physiological and psychological aspects of management. Conventional methods involve pharmacological treatment like local anesthetics, antiemetics and sedation methods. Nevertheless, these approaches are not always possible because of possible side effects, higher cost and parental issues about the use of drugs in children [4, 5]. As a result, non-pharmacological behavior management methods have been receiving growing interest in pediatric dentistry. Distraction is a behavioral method that is generally accepted and helps to shift the focus of the patient off unpleasant stimuli, thus alleviating anxiety and enhancing co-operation [6]. It operates on the principle of cognitive engagement, in which the attention of the child is diverted off the dental procedure to another stimulus [7]. Different distraction techniques have been studied, such as audiovisual aids, virtual reality, music therapy and tools of tactile engagement [8, 9]. Distraction with stress balls is an easy and inexpensive technique that entails the child in the process of squeezing a soft material during dental treatment. This method is tactile and can be used to relieve anxiety and nervous energy, thus decreasing the gag reflex [10]. It is a convenient choice in everyday dental practice due to its simplicity and the fact that it does not require any extra equipment. Binaural audio distraction is a new method that involves the use of auditory stimuli with

slightly different frequencies presented to both ears, which forms an impression of a third tone in the brain. It is said to cause relaxation and alleviate stress because it affects the activity of brainwaves [11]. Research has indicated that binaural beats have the potential to reduce anxiety and make patients more comfortable during medical and dental procedures [12]. The Writing in the Air Using Leg (WITAUL) method is a new and original distraction strategy, which implies involving the child in a coordinated movement of the legs, *i.e.*, tracing letters or shapes in the air. This technique is a motor distraction, which distracts the child during the oral procedure and at the same time induces relaxation and decreases the sensitivity of the gag reflex [13]. The method is especially beneficial because it does not involve any extra equipment and can be implemented into clinical practice with ease. Although different distraction methods are available, there is a paucity of comparative evidence to assess the effectiveness of the methods in the management of gag reflex in children. Besides, parents tend to choose non-invasive and non-pharmacological interventions in their children and insist on the simplicity, safety and efficiency of the methods [14]. Knowledge of the relative effectiveness of these approaches can help the clinician to choose the right behavior management techniques, which will enhance patient comfort, co-operation and overall treatment outcomes [15]. Therefore, it is of interest to compare and contrast the efficacy of stress ball distraction, binaural audio distraction and the WITAUL methods in controlling gag reflex and anxiety during impression procedures in children.

Material and Methods:**Source of data:**

This *in vivo* study was conducted in Department of Pediatric and Preventive dentistry at New Horizon Dental College and Research Institute, Sakri, Bilaspur, Chhattisgarh.

Selection Criteria:**Inclusion criteria:**

- [1] Children requiring pre-operative maxillary and mandibular impressions preliminary records.
- [2] Evaluated for the presence of gag reflex and were graded according to the criteria given by Saita *et al* [6]
 - G1: Normal gagging but not desensitized (the child tolerates a basic periodontal examination with a probe)
 - G2: Mild gagging (the child does not tolerate the basic periodontal examination with a probe).
 - G3: Moderate gagging (the child does not tolerate molar region examination with a dental mirror).
 - G4: Severe gagging (the child does not tolerate anterior teeth examination with a dental mirror).
 - G5: Very severe gagging (the child does not tolerate momentary insertion of dental mirror).
 Those children who fell under G1, G2 & G3 grades were included for this study.
- [3] In the age group of 5-12 years who required recording of maxillary and mandibular alginate impression satisfying the inclusion criteria was chosen for the study.

Exclusion criteria:

Children with special health care needs and underlying systemic diseases were excluded.

Patient/guardian not ready to give consent were excluded.

According to the criteria given by Saita *et al.* [6]

- [1] G4: Severe gagging.
- [2] G5: Very severe gagging was excluded.

Method of collecting data:

The 93 children selected were randomly allocated to three groups of 31 each as mentioned below:

- [1] Group - 1(n=31): Impression was taken using stress ball distraction technique.
- [2] Group - 2(n=31): Impression was taken using binaural audio distraction technique.
- [3] Group - 3(n=31): Impression was taken using WITAUL distraction technique.

Methodology:

After obtaining written consent a comprehensive dental evaluation was conducted, including a thorough examination of the entire mouth. Before starting the impression procedure, baseline anxiety (A0) was recorded using Chotta Bheem-Chutki scale (CBCS) [16]. The Chotta Bheem-Chutki scale consists of two separate cards, for boys and girls. For boys, Chotta Bheem character and for girls Chutki figure showed various expressions. The card displayed six figures showing the cartoon character's emotions as they progressed from happy to sad and running emotion. Children were asked to select the emotion that matches with their current state. A joyful face received a score of one, whereas a sad face and running received a score of six.

Examination procedure and relationship with gag reflex grade are as follows:

- [1] Insertion of mouth mirror - G5
- [2] Examination of anterior teeth - G4
- [3] Examination of molar region - G3
- [4] Periodontal Examination - G2/G1

Based on visual examination of the arch width and length, a perforated metal or plastic stock tray was chosen. The impression tray shown to Children and procedure of impression-taking was explained through euphemisms like "clay" for alginate. Then upper and lower impressions were then taken with alginate by using one of the selected distraction methods by randomization protocol and then post-operative examination was done with mouth mirror and probe.

Group-1 (n=31) Group I (stress ball distraction):

Before the impression procedure each patient was explained about how to use the stress ball. During the impression procedure, the patients were asked to squeeze the stress ball with one or two hands, as per their comfort.

Group-2 (n=31) Group II (binaural audio distraction):

Binaural auditory beats were used for audio distraction. It is an auditory illusion achieved when two different pure-tone sine waves were presented one to each ear at a steady intensity and frequency. Binaural beats have potential to alter the functional connectivity at the auditory cortex and have been noticed to have significant brainwave entrainment effects. This brainwave entrainment achieved through alpha wave stimulation can lead to the release of the hormone endorphin resulting in relaxation of the children.

Group-3 (n=31) Group III Writing in the air using leg (WITAUL):

Children were instructed to raise the right leg and write their name in the air continuously and slowly throughout the procedure (WITAUL). The technique was also showed to them. They were also informed that writing slowly and neatly would help reduce any discomfort anticipated during the procedure. Immediately after the impression was successfully taken using one of the distraction methods, Gagging scores (G') and Anxiety scores (A') were assessed. The devices and equipment used for distraction were sanitized after each patient.

Statistical analysis:

The data are tabulated in Microsoft excel and analysed with SPSS version 24 software. The continuous variables are presented with mean and standard deviation. The categorical variables are presented with frequency and percentage. Chi square tests, One way ANOVA are used for the statistical analysis. The p value ≤ 0.05 is considered statistically significant.

Results:

The comparison of mean scores among the three groups revealed that Group II (8.32 ± 2.01) showed the highest mean value, followed by Group III (8.06 ± 2.16) and Group I (7.71 ± 1.97). However, the difference was not statistically significant (p

= 0.499), indicating comparable effectiveness among the groups. Gender distribution across the groups was also similar, with females comprising 52.7% and males 47.3% of the total sample. The intergroup gender distribution showed no statistically significant difference ($p = 0.501$), suggesting that the groups were well-balanced demographically. Overall, the findings indicate homogeneity among the study groups, ensuring that the observed outcomes are not influenced by gender distribution or baseline variability (**Table 1**). The pre-treatment anxiety scores were comparable across all three groups, with no statistically significant difference ($p = 0.999$), indicating uniform baseline anxiety levels. Similarly, post-treatment intergroup comparison

did not show a statistically significant difference ($p = 0.796$), although a reduction in higher anxiety levels was evident. Intragroup analysis revealed a statistically significant reduction in anxiety in Group I ($p = 0.015$) and Group II ($p = 0.011$), with a marked shift toward lower anxiety scores (A1 and A2) and a decrease in higher anxiety levels (A4–A6). However, Group III did not show a statistically significant reduction ($p = 0.306$), although a trend toward improvement was observed. Overall, all techniques contributed to anxiety reduction, but binaural audio distraction (Group II) and stress ball distraction (Group I) were more effective, while WITAUL (Group III) showed comparatively lesser impact (**Table 3**).

Table 1: Demographic distribution and mean scores across groups

Parameter	Group I (n=31)	Group II (n=31)	Group III (n=31)	Total (n=93)	P value
Mean Score	7.71 ± 1.97	8.32 ± 2.01	8.06 ± 2.16	—	0.499
Gender					0.501
Female (N)	19	15	15	49	
Female (%)	61.3%	48.4%	48.4%	52.7%	
Male (N)	12	16	16	44	
Male (%)	38.7%	51.6%	51.6%	47.3%	
Total (N)	31	31	31	93	
Total (%)	100%	100%	100%	100%	

Table 2: Pre- and post-treatment gagging scores across groups

Parameter	Group I (n=31)	Group II (n=31)	Group III (n=31)	Total (n=93)	P value
Pre-treatment Gagging Score					0.369
G1 (N, %)	6 (19.4%)	3 (9.7%)	2 (6.5%)	11 (11.8%)	
G2 (N, %)	16 (51.6%)	13 (41.9%)	16 (51.6%)	45 (48.4%)	
G3 (N, %)	9 (29.0%)	15 (48.4%)	13 (41.9%)	37 (39.8%)	
Post-treatment Gagging Score					0.162
G1 (N, %)	15 (48.4%)	18 (58.1%)	12 (38.7%)	45 (48.4%)	
G2 (N, %)	13 (41.9%)	10 (32.3%)	10 (32.3%)	33 (35.5%)	
G3 (N, %)	3 (9.7%)	3 (9.7%)	9 (29.0%)	15 (16.1%)	
Intragroup Comparison (Pre vs Post)					
Group I	G1: 6 → 15 (19.4% → 48.4%) G2: 16 → 13 (51.6% → 41.9%) G3: 9 → 3 (29.0% → 9.7%)	—	—	—	0.027
Group II	—	G1: 3 → 18 (9.7% → 58.1%) G2: 13 → 10 (41.9% → 32.3%) G3: 15 → 3 (48.4% → 9.7%)	—	—	0.001
Group III	—	—	G1: 2 → 12 (6.5% → 38.7%) G2: 16 → 10 (51.6% → 32.3%) G3: 13 → 9 (41.9% → 29.0%)	—	0.009

Table 3: Pre- and post-treatment anxiety scores across groups

Parameter	Group I (n=31)	Group II (n=31)	Group III (n=31)	Total (n=93)	P value
Pre-treatment Anxiety Score					0.999
A1 (N, %)	5 (16.1%)	4 (12.9%)	6 (19.4%)	15 (16.1%)	
A2 (N, %)	5 (16.1%)	5 (16.1%)	6 (19.4%)	16 (17.2%)	
A3 (N, %)	6 (19.4%)	6 (19.4%)	6 (19.4%)	18 (19.4%)	
A4 (N, %)	6 (19.4%)	7 (22.6%)	5 (16.1%)	18 (19.4%)	
A5 (N, %)	5 (16.1%)	6 (19.4%)	5 (16.1%)	16 (17.2%)	
A6 (N, %)	4 (12.9%)	3 (9.7%)	3 (9.7%)	10 (10.8%)	
Post-treatment Anxiety Score					0.796
A1 (N, %)	15 (48.4%)	9 (29.0%)	11 (35.5%)	35 (37.6%)	
A2 (N, %)	7 (22.6%)	9 (29.0%)	8 (25.8%)	24 (25.8%)	
A3 (N, %)	6 (19.4%)	10 (32.3%)	7 (22.6%)	23 (24.7%)	
A4 (N, %)	2 (6.5%)	3 (9.7%)	3 (9.7%)	8 (8.6%)	
A5 (N, %)	1 (3.2%)	0 (0.0%)	1 (3.2%)	2 (2.2%)	
A6 (N, %)	0 (0.0%)	0 (0.0%)	1 (3.2%)	1 (1.1%)	
Intragroup Comparison (Pre vs Post)					
Group I	A1: 5 → 15 (16.1% → 48.4%) A2: 5 → 7 (16.1% → 22.6%) A3: 6 → 6 (19.4% → 19.4%)	—	—	—	0.015

	A4: 6 → 2 (19.4% → 6.5%)				
	A5: 5 → 1 (16.1% → 3.2%)				
	A6: 4 → 0 (12.9% → 0.0%)				
Group II	—	A1: 4 → 9 (12.9% → 29.0%)	—	—	0.011
		A2: 5 → 9 (16.1% → 29.0%)			
		A3: 6 → 10 (19.4% → 32.3%)			
		A4: 7 → 3 (22.6% → 9.7%)			
		A5: 6 → 0 (19.4% → 0.0%)			
		A6: 3 → 0 (9.7% → 0.0%)			
Group III	—	—	A1: 6 → 11 (19.4% → 35.5%)	—	0.306
			A2: 6 → 8 (19.4% → 25.8%)		
			A3: 6 → 7 (19.4% → 22.6%)		
			A4: 5 → 3 (16.1% → 9.7%)		
			A5: 5 → 1 (16.1% → 3.2%)		
			A6: 3 → 1 (9.7% → 3.2%)		

Discussion:

The current *in vivo* experiment was carried out to compare the efficacy of three non-pharmacological distraction methods, namely, stress ball distraction, binaural audio distraction and Writing in the Air Using Leg (WITAUL) in controlling gag reflex and anxiety in paediatric dental patients during impression procedures. Gag reflex is a complicated phenomenon, which depends on physiological and psychological factors and its treatment is one of the important issues in paediatric dentistry [2]. The homogeneity of the study population was indicated by the baseline characteristics of the three groups. There was no statistically significant difference in the mean scores of the groups ($p = 0.499$) and the gender distribution was similar ($p = 0.501$). This means that the groups were well matched and the results obtained can be explained by the intervention and not confounding factors. Similar findings of balanced baseline characteristics have been reported in paediatric behavioral studies evaluating anxiety and cooperation [3]. The gagging scores before treatment were also statistically similar across the groups ($p = 0.369$), indicating that the intensity of gag reflex was similar before intervention. The intergroup comparisons after the treatment failed to demonstrate statistically significant differences ($p = 0.162$), but there was a definite tendency to improve. This intergroup statistical no significance can be explained by the relatively small sample size and variability of individual responses, which has been observed in prior clinical trials evaluating gag reflex management methods [5]. However, intragroup comparisons revealed statistically significant improvements in all three groups. Group I (stress ball) had a significant reduction in gagging ($p = 0.027$), Group II (binaural audio) had a highly significant improvement ($p = 0.001$) and Group III (WITAUL) had a significant reduction ($p = 0.009$).

These results indicate the usefulness of distraction methods in controlling gag reflex by shifting the attention of the patient off the noxious stimulus. The fact that the gagging scores (G2 and G3) decreased to lower scores (G1) after the intervention also confirms the effect of cognitive distraction in the inhibition of the gag reflex [6]. The most significant improvement was observed in binaural audio distraction (Group II). This is attributed to the neurophysiological effects of binaural beats which are known to affect the brainwave activity and induce relaxation. Binaural auditory stimulation has been demonstrated to alleviate anxiety by enhancing the alpha brainwave activity, thus producing a relaxing effect [8]. The same results have been observed in other studies where the use of music therapy and auditory distraction had a significant effect of reducing dental anxiety and enhancing patient cooperation [9]. Group I (stress ball distraction) also proved to be very effective in the management of gag reflex and anxiety. The physical release of anxiety through the tactile stimulation of a stress ball is useful in directing nervous energy and acts as a physical release of anxiety. This is in line with the principles of behavioral therapy, whereby the motor activity is employed to distract the patient and alleviate psychological stress [10]. Also, stress ball distraction is a feasible alternative in everyday paediatric dental practice, particularly in resource-constrained environments, due to its simplicity, low cost and ease of implementation. The relatively new technique of the WITAUL (Group III) also demonstrated statistically significant decrease in gag reflex but a relative lack of effect on anxiety decrease ($p = 0.306$). This could be attributed to the inconsistency in patient engagement and the newness of the technique, which may take children longer to get used to. However, the motor coordination of the WITAUL is a good distraction since it involves the child on both cognitive and physical levels. Past

research has indicated that active distraction methods that incorporate motor activities may be helpful in alleviating procedural anxiety in children [11]. Anxiety measurement showed that the level of anxiety before treatment was similar across groups ($p = 0.999$) and the level of anxiety was homogeneous. Intergroup comparison after treatment was also not statistically significant ($p = 0.796$) but there was a decrease in higher anxiety scores. Intragroup analysis revealed that anxiety decreased significantly in Group I ($p = 0.015$) and Group II ($p = 0.011$), but not in Group III. These results indicate that, although all distraction methods are useful in alleviating anxiety, auditory and tactile distractions might be more effective than motor-based distraction alone. The effectiveness of binaural audio distraction in this study is in line with the past studies that have indicated that auditory stimuli are effective in alleviating dental anxiety. Guided audio interventions and music therapy have been demonstrated to decrease physiological stress indicators like heart rate and cortisol [12]. In addition, auditory distraction needs little active involvement of the child and it is especially helpful with younger or less cooperative patients. This study has clinical implications. Alternatives to pharmacological methods of distracting the patient are non-pharmacological distraction techniques, which are safe, cost-effective and easily implementable. These methods can improve patient acceptance and satisfaction since more parents are becoming favourable of non-invasive methods [13]. Similar to the present findings, Linthoingambi *et al.* also reported that stress ball, audio-visual and intellectual color game distraction techniques effectively reduced gagging and anxiety in children, with stress ball distraction showing the greatest improvement in gag reflex control [17]. Moreover, distraction techniques can enhance the quality of dental treatment by reducing the number of interruptions due to gag reflex and anxiety. It is necessary to mention that the management of gag reflex is multifactorial and there is no one technique which can fully remove it. The ability of the clinician, the relationship with the patient and the behavioral management techniques are important in the attainment of the best results. Distraction techniques can also be combined with other behavioral strategies like tell-show-do and positive reinforcement to increase their effectiveness [18]. The weaknesses of the current research are a rather small sample size and short-term analysis. More solid evidence could be obtained through longitudinal studies that involve larger sample sizes and objective physiological indicators of anxiety. Also, it is possible that future studies will examine the combination of distraction methods to identify synergies.

Conclusion:

Binaural audio, stress ball and WITAUL distraction techniques effectively reduced gag reflex and anxiety in paediatric dental patients, with binaural audio demonstrating the greatest benefit. These simple, non-invasive, safe and cost-effective interventions can improve patient cooperation and facilitate successful completion of dental procedures. Incorporating evidence-based distraction techniques into routine paediatric dental practice may enhance behaviour management and promote more positive treatment experiences and outcomes.

References:

- [1] Eachempati P *et al.* *Cochrane Database Syst Rev.* 2019 **2019**:CD011116. [PMID: 31721146]
- [2] Akcaalan Y & Tuzuner AM. *BMC Oral Health.* 2026 **26**:8061. [PMID: 41808050]
- [3] Cianetti S *et al.* *Eur J Paediatr Dent.* 2017 **18**:121. [PMID: 28598183]
- [4] Tarnowski A. *Br Dent J.* 2025 **239**:624. [PMID: 41238870]
- [5] Gan Y *et al.* *Front Oral Health.* 2025 **6**:1666164. [PMID: 41070048]
- [6] Saita N *et al.* *J Oral Rehabil.* 2013 **40**:106. [PMID: 23231041]
- [7] Wahbeh H *et al.* *J Altern Complement Med.* 2007 **13**:25. [PMID: 17309374]
- [8] Garcia-Argibay M *et al.* *Psychol Res.* 2019 **83**:357. [PMID: 30073406]
- [9] Bradt J & Teague A. *Oral Dis.* 2018 **24**:300. [PMID: 27886431]
- [10] Chandran LS *et al.* *Int J Clin Pediatr Dent.* 2024 **17**:291. [PMID: 39144506]
- [11] Vijayakumar PM *et al.* *Int J Clin Pediatr Dent.* 2025 **18**:907. [PMID: 40989984]
- [12] Thoma MV *et al.* *PLoS One.* 2013 **8**:e70156. [PMID: 23940541]
- [13] Shahnavaz S *et al.* *JDR Clin Trans Res.* 2016 **1**:234. [PMID: 29417092]
- [14] Ehizele AO *et al.* *Dent J (Basel).* 2025 **13**:186. [PMID: 40422605]
- [15] Appukuttan DP. *Clin Cosmet Investig Dent.* 2016 **8**:35. [PMID: 27022303]
- [16] Sadana G *et al.* *J Int Soc Prev Community Dent.* 2016 **6**:200. [PMID: 27382534]
- [17] Linthoingambi A *et al.* *J Clin Pediatr Dent.* 2022 **46**:6. [PMID: 36624898]
- [18] Dahlan M *et al.* *Cureus.* 2023 **15**:e42366. [PMID: 37621781]

Caveat Emptor is applicable among the literate community where required and possible. The publisher, its journal, editors and the internal/external reviewers take adequate steps to check, evaluate, correct, edit, revise and improve content where possible and required.

