

## REVIEW ARTICLE

# A CONTEMPORARY REVIEW ON INDICES FOR GINGIVAL ENLARGEMENT

Sakshi Dubey<sup>1</sup>, Deepti Gattani<sup>2</sup>, Snehal Deotale<sup>1</sup>, Mohsin Quazi<sup>3</sup>

<sup>1</sup>P.G. Student, <sup>2</sup>Professor and Head, Department of Periodontology, <sup>3</sup>Sr. Lecturer, Department of Prosthodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra.

### ABSTRACT:

There are numerous vacillating etiologies of gingival overgrowth or gingival enlargement which most commonly affects the connective tissue elements of the gingiva. Depending on the cause, the operator proposes the management of gingival overgrowth. As far as the literature is concerned for all types of gingival overgrowth the consequences of the treatment depends on the extent, severity and the etiopathogenesis behind it. Hence, we need to know various methodologies to measure all these parameters for a successful means of treatment. Most common method of assessment of the gingival overgrowth is with the help of a suitable index. Therefore focusing on all the indices for gingival enlargement we have tried to describe various indices present in the literature for the benefit of clinician.

**Keywords:** Gingival overgrowth, indices, gingival enlargement.

Corresponding author: Dr. Sakshi Dubey, III Yr P.G. Student, Department of Periodontics, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur. Email: drsakshi.dubey@gmail.com

This article may be cited as: Dubey S, Gattani D, Deotale S, Quazi M. A contemporary review on indices for gingival enlargement. J Adv Med Dent Scie Res 2016;4(4):62-67.

Access this article online	
<p><b>Quick Response Code</b></p> 	<p>Website: <a href="http://www.jamdsr.com">www.jamdsr.com</a></p>
	<p><b>DOI:</b></p> <p>10.21276/jamdsr.2016.4.4.17</p>

### INTRODUCTION:

Gingival enlargement is the proliferation and intensification of the gingiva which is a prevailing character of the diseased gingival tissues. As per the literature “Gingival Enlargement” and “Gingival Overgrowth” are the ongoing approved clinical nomenclatures used to construe this clinical manifestation. However “Hypertrophic Gingivitis”, “Gingival Hypertrophy” and “Gingival Hyperplasia” were the former histopathological loculations which are not applicable these days considering that it is unable to differentiate clinically in the increase in the number of cells or in the size of the cells<sup>1</sup>. The former two clinical terminologies are well accepted and thus is used in this review article abbreviated as “GE” & “GO” respectively.

Various mechanisms have been described by the investigators in the etiopathogenesis of GO. In inflammatory GO, the microorganisms produces certain toxic substances like collagenases, hyaluronidase, chondriotin sulphate, proteases etc which cause damage to the epithelium & connective tissue along with intercellular components leading to widening of small capillaries and venules with formation of capillary loops between retepegs.<sup>2</sup> In this process the PMN’s undergo diapedesis and emigration and thus cause cytotoxic alterations in fibroblasts and decrease the production of collagen. Similarly in drug induced gingival overgrowth (DIGO), the collagenous components accumulate in the extracellular compartment due to the disturbances in integrins specially alpha 2 beta 1 integrin and alpha 2 integrin which are specific receptors for type I collagen on fibroblasts and

collagen phagocytosis respectively.<sup>3</sup> Apart from integrins there are disturbances in actin filaments also which are involved in collagen internalization. However, in hormonal enlargement the estrogen-progesterone mechanism plays a pivotal role affecting the vascular permeability leading to edema of tissues.<sup>4</sup>

In order to treat and prevent the recurrence of GO, the operator must recognize the extent of the vertical and the horizontal components as well as the severity of GO along with its etiopathogenesis. There are numerous methods to determine the severity of GO, out of which an index being the most common. Different authors have proposed different indices and got variable results. Hence the present article reviews in detail all the indices proposed till date so as to provide the clinician a systematic approach for using multiple indices simultaneously and conveniently to define a clinical scenario in routine periodontal practice.

#### VARIOUS INDICES:

1. Angelopoulos and Goaz (1972)<sup>5</sup> described an index for measuring the vertical component of gingiva. Three grades based on the enlargement covering the clinical crown were described as:

- a. Grade 0: None.
- b. Grade I: Not more than 1/3<sup>rd</sup> of the clinical crown covered.
- c. Grade II: Any part of the middle third of the crown covered.
- d. Grade III: Greater than 2/3<sup>rd</sup> of the crown covered.

2. Miller and Damm (1992)<sup>6,7</sup> modified the original Angelopoulos and Goaz index for enhanced assessment of gingival overgrowth. The enlargement was divided into a vertical and a horizontal component and abbreviated as GOI index. The vertical component is measured from cemento-enamel junction to the free gingival margin and the horizontal component from the enamel surface at the point of contact to the external margin of the interdental papilla.

The vertical gingival overgrowth index is described as:

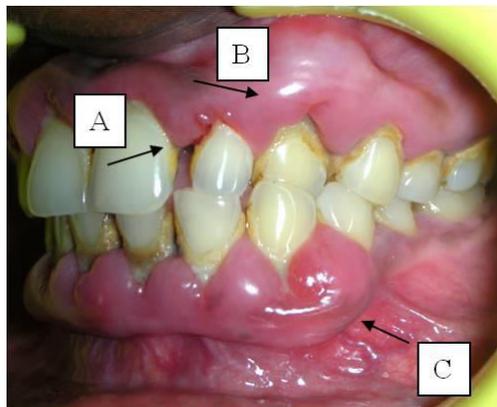
- a. Grade 0: Normal gingival, no alteration
- b. Grade 1: Minimal overgrowth, ≤ 2mm, gingiva covering the cervical third or less of the anatomic crown.
- c. Grade 2: Moderate overgrowth: 2 to 4 mm, gingival covering the middle third of the anatomic crown.
- d. Grade 3: Severe overgrowth: ≥4mm, nodular growth, gingival covering more than two thirds of the dental crown.

The horizontal gingival overgrowth index is described as:

- a. Grade 0: < 1mm
- b. Grade 1: 1 to 2 mm
- c. Grade 2: > 2 mm

3. Seymour RA (1985)<sup>8</sup> described a gingival overgrowth index (GOi), in which assessment of gingival

hyperplasia is done on plaster study casts that includes both horizontal and vertical overgrowth focusing on the anterior teeth since the overgrowth is more likely to occur in this region. Various authors have suggested that this index allows a three dimensional diagnosis of gingival overgrowth.



**Figure 1:** A. Blunting of gingival margin, B. Lateral spread of papilla across buccal tooth surface, C. Loss of normal papilla form (marked encroachment of papilla).

The scores according to Seymour et al 1985 are:

- a. 0 = No encroachment of the interdental papilla onto the tooth surface
- b. 1 = Mild encroachment of the interdental papilla, producing a blunted appearance to papilla tip
- c. 2 = Moderate encroachment, involving lateral spread of papilla across buccal tooth surface of less than one quarter of tooth width
- d. 3 = Marked encroachment of papilla, i.e. more than 1/4<sup>th</sup> tooth width. Loss of normal papilla form

A clinical score of greater than or equal to 2 was regarded as clinically significant and such patients were considered into clinically significant overgrowth category i.e. 2 or 3. And those with little changes or no changes were given a score of 0 or 1.

Ellis JS, Seymour RA et al (2001)<sup>9</sup> described a photographic analysis of gingival overgrowth in which photographs of the anterior buccal gingiva was taken with camera of appropriate speed and an F-stop of 11, (Pentax K 1000 camera body, Tamron Sp 90 mm 1:25 lens, Cobra Macro Ring flash). Focus was obtained at approximately 40 cm distance and the scoring was done with the help of Harris and Ewalt index as described later.

4. Bokenkamp A and Bohnhorst B (1994)<sup>10,11</sup> categorized gingival overgrowth dimensions into the following grades:

- a. Grade 0: No signs of gingival overgrowth
- b. Grade I: Gingival hyperplasia confined to interdental papilla
- c. Grade II: Hyperplasia of interdental papilla and marginal gingival

d. Grade III: Gingival hyperplasia covering at least three-quarters of tooth crowns

5. Mc Gaw T et al (1987)<sup>12, 13</sup> introduced a gingival overgrowth index while describing a correlation between cyclosporine induced gingival overgrowth and dental plaque. They have grouped the overgrowth ranging from 0 to 3 as shown below:

- a. Score 0: No overgrowth, feather-edged gingival margin
- b. Score 1: Blunting of gingival margin; only interdental papilla is involved
- c. Score 2: Moderate gingival overgrowth (< 1/3 of crown length)
- d. Score 3: Marked gingival overgrowth (> 1/3 of crown length)

Scores from 0 to 3 was assigned to every tooth for labial/ buccal and lingual/ palatal surfaces. It was considered from midpoint of mesial papilla crossing the tooth to the midpoint of distal papilla of the same tooth.

6. King GN et al (1993)<sup>14</sup> established a gingival enlargement index while conducting the study on renal allograft recipients who were on cyclosporine A and calcium antagonists. In this study the gingival hyperplasia was evaluated using a hyperplastic index (HI). In this method an alginate impressions of maxillary and mandibular jaws were made and models were prepared. On these models 12 anterior teeth i.e. 6 maxillary anterior and 6 mandibular anterior teeth were assessed which comprised of evaluation of both horizontal and vertical extension. In each dental arch there were five gingival units which were calculated from midpoint of one tooth to the midpoint of adjacent tooth of both buccal and lingual surfaces of all 12 teeth. In cases where one tooth was missing than premolar is taken as a substitute. The vertical extension of the HI index was assessed in an apico-coronal direction and was scored by using a 4-point interval scale as given below:

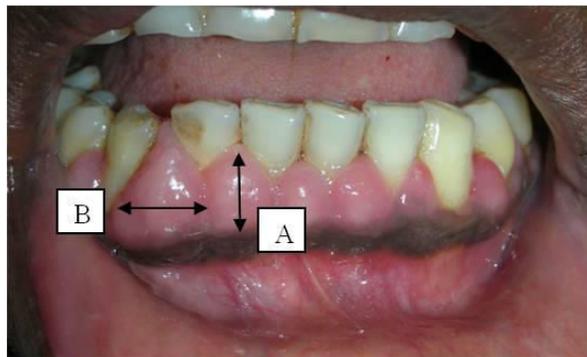
- a. Grade 0: no gingival hyperplasia
- b. Grade 1: Mild hyperplasia (blunting of gingival margin)
- c. Grade 2: Moderate hyperplasia (less than 1/2 of crown length)
- d. Grade 3: Marked hyperplasia (greater than 1/2 of crown length)

The horizontal component (labio-lingual) of HI was measured by using Seymour et al (1985) method on both labial and lingual aspects and scored as:

- a. Grade 0: Normal width of free gingival margin
- b. Grade 1: thickening from the normal upto 2mm
- c. Grade 2: thickening from the normal > 2mm

The maximum score that can be obtained from HI index is 5 and the vertical & horizontal extensions were added, thus an individual score for each tooth is obtained. Therefore total 20 gingival units were evaluated including upper &

lower and buccal & lingual surfaces and the definite degree of hyperplasia were expressed as percentage. (Figure.2)



**Figure 2:** A. Vertical extension, B. Horizontal extension

Further Seymour and Smith (1991) suggested that subjects showing HI score more than 30% are the only sufferers of considerable gingival enlargement, hence King et al alienated the subjects into two subgroups based on their scores as:

- Responders (patients with a HI score more than 30%)
- Non-responders (patients with a HI score less than or equal to 30%)

7. Harris and Ewalt (1942)<sup>15</sup> classified the enlargement stages from grade 0 as no clinical evidence of overgrowth to grade 4 as enlargement covering at least 3/4<sup>th</sup> of total crown. It was later elaborated into five categories (Modified Harris and Ewalt index) as follows:

- a. Score 0: No clinical hyperplasia
- b. Score 1: Minimal, impression of increased density plus increase stippling, firm, loss of corrugation, lost knife edge margin, no increase in size of papilla.
- c. Score 2: Moderate, increase size of papilla, within facio-proximal and linguo-proximal line angles, rolled margins.
- d. Score 3: Marked, encroachment upon anatomic crown - < 50% inciso-gingivally or mesio-distally.
- e. Score 4: Severe, encroachment upon anatomic crown - > 50% inciso-gingivally or mesio-distally.
- f. Score 5: Interference with function.

8. Ingle JI et al (1959)<sup>16</sup> measured the distances between the gingival tissue and the incisal edge of all six anterior teeth on a study casts with the help of a millimeter scale. In this method three points were measured as given below:

- a. Incisal edge to mesial interdental papilla
- b. Incisal edge to distal interdental papilla
- c. Incisal edge to marginal gingival

From these measurements an average value was obtained and compared to additional casts of the same patient during

the treatment and charted as increase or decrease in the hyperplasia levels.

9. Eva and Ingles (1999)<sup>17</sup> introduced a new index for measuring gingival overgrowth caused due to drugs. In this index for standardization, the buccal and lingual papillae were scored separately. The criteria by which scores were divided are as mentioned below:
  - a. Grade 0: No overgrowth, firm adaptation of the attached gingiva to the underlying alveolar bone. There is slight stippling; there is no granular appearance. A knife-edged papilla is present toward the occlusal surface and no increase in density or size of the gingiva.
  - b. Grade 1: Early overgrowth, as evidenced by an increase in density of the gingiva with marked stippling and granular appearance. The tip of the papilla is rounded and the probing depth is less than or equal to 3mm.
  - c. Grade 2: Moderate overgrowth, manifested by an increase in the size of the papilla and/ or rolled gingival margins. The contour of the margin is still concave or straight. Also the enlargement has a buccolingual dimension of up to 2mm, measured from the tip of the papilla outward. The probing depth is equal to or less than 6mm and the papilla is somewhat retractable.
  - d. Grade 3: Marked overgrowth, represented by encroachment of the gingiva onto the clinical crown. Contour of the margin is convex rather than concave. The enlargement has a buccolingual dimension of approximately 3 mm or more, measured from the tip of the papilla outward. The probing depth is greater than 6mm and the papilla is clearly retractable.
  - e. Grade 4: Severe overgrowth, characterized by a profound thickening of the gingiva. A large percentage of the clinical crown is covered. The papilla is retractable, the probing depth is greater than 6 mm and the buccolingual dimension is approximately 3 mm.
10. Aas index (1963)<sup>18</sup>: Aas index divides the quadrant into sextants and were graded as:
  - a. Grade 0: No gingival enlargement. The gingiva follows a normal contour on all teeth.
  - b. Grade 1: Slight or moderate gingival enlargement. The interdental papillae have assumed a more rounded blunt form; the gingival margin is slightly thickened. The anatomical crowns are covered up to one-third of the vestibular surfaces.
  - c. Grade 2: Marked gingival enlargement. The papillae and the gingival margin cover from one-third to one-half of the vestibular surfaces. In most cases, the papillae are separated only by a V-shaped cleft.
  - d. Grade 3: Severe gingival enlargement. The gingiva propria covers one-half to two-thirds of the vestibular surfaces and protrudes 3-4 mm from the surface of the teeth.
  - e. Grade 4: Very severe gingival enlargement. The hyperplastic tissue covers from two-thirds to the whole of the anatomical crowns in one or more regions, and occlusion is rendered difficult, if not prevented.
11. Babcock and Nelson (1964)<sup>19</sup> described an index which has three gradings as:
  - a. Minimal: No hyperplasia, or as little as to be dubious.
  - b. Moderate: Definite hyperplasia of gingiva, with encroachment on the clinical crown of the teeth, but with no interference of function.
  - c. Severe: Gingival enlargement interfering with function.
12. Miranda and Brunet index (2001)<sup>20</sup> described an index in which horizontal measurement of the enlargement is possible. This index is also termed as nodullary papilla index. In this index the measurement is carried out with the help of a periodontal probe from the enamel surface of the interdental contact point to the outer papillary area. The scores of this index is as mentioned below:
  - a. Score 0: Papilla thickness < 1 mm
  - b. Score 1: Papilla thickness 1- 2 mm
  - c. Score 2: Papilla thickness > 2 mm
13. Other miscellaneous indices:
  - a. Kimball (1939)<sup>21</sup> described gingival overgrowth in a very nonspecific way and divided into four grades.
  - b. Conard GJ (1974)<sup>22</sup> while measuring the levels of 5, 5- Diphenylhydantoin in human serum, saliva and hyperplastic gingival described the scores for gingival enlargement from 0 to 4 in which zero indicates no clinical signs of hyperplasia and four indicates the teeth were completely covered with hyperplastic tissue.
  - c. Friskopp J and Klintmalm G (1986)<sup>23</sup> classified the gingival overgrowth into three subtypes, from minute to severe depending on the severity of the enlarged tissue.
  - d. Daley TD et al (1986)<sup>24</sup> utilized 0 to 5 numbers for categorizing each buccal and lingual aspect of the interdental papilla and a mean score was calculated.
  - e. Barak S et al (1987)<sup>25</sup> had given a histological classification depending on the length of the rete ridges from grade 1 (Normal gingival- width of epithelium from 0.30 to 0.50 mm) to grade 4 (Severe hyperplasia- width of epithelium from 3.0 to 4.0).
  - f. Heijl L and Sundin Y (1988)<sup>26</sup> scored mesial, buccal and distal sites individually after visualizing the changes in the size of the gingiva clinically.
  - g. Pasqualin F et al (1990)<sup>27</sup> had focused on the extent of the proliferated gingiva on the keratinized tissue and the number of quadrants involved and classified form grade 0 to grade 3.
  - h. Kitamura K et al (1990)<sup>28</sup> measured the enlargement with the help of a probe having color strips of 50 µm bands in five different colors which was inserted into the sulcus under a stereoscopic dissecting microscope

and the size of the gingiva was measured from the free gingival margin to the bottom of the gingival sulcus.

- i. Hefti AF et al (1994)<sup>29</sup> graded the gingival enlargement from grade 0 (no visible overgrowth) to grade 3 (large masses of overgrowth). In this study the examiners scored the enlargement by visualizing the clinical photographs.
- j. Nery EB et al (1995)<sup>30</sup> incorporated the interproximal region in the Angelopoulos and Goaz's method and thus modified the original index.
- k. O'Valle F et al (1995) and Pernu HE et al (1992)<sup>31</sup> classified gingival overgrowth into four categories based on the amount of clinical crown covered by tissue.

### CONCLUSION:

Various gingival overgrowth indices have been proposed for accurate measurement of the enlarged tissue to draw conclusions regarding severity of the enlargement and the treatment accordingly. However, the prognosis of the involved tissue depends on both horizontal and vertical components of the enlargement which was missing in most of the indices described in this review. Additionally a detailed description of the complete periodontium and other factors should be incorporated as described in the index given by Eva and Ingles which will facilitate proper treatment approach for the diseased tissue. Also variations exist between subjects in terms of etiological factors for which King divided the subjects into responders and nonresponders for drug induced gingival enlargement which additionally helps to categorize the patients properly for carrying out the studies on large scale.

### REFERENCES:

1. Fermin A, Carranza and Eva L. Hogan. Gingival enlargement. Fermin A. Carranza's Clinical Periodontology, 11<sup>th</sup> ed. Restricted South Asia Edition: An imprint of Elsevier; 2010.p. 373-90.
2. Shukla P, Dahiya V, Kataria P, Sabharwal S. Inflammatory hyperplasia: From diagnosis to treatment. J Indian Soc Periodontol, 2014; 18 (1):92-94.
3. Kataoka M, Kido J, Shinohara Y, Nagata T. Drug-induced gingival overgrowth - a review. Biol Pharm Bull. 2005 Oct; 28(10):1817-21.
4. Srivastava A, Gupta KK, Srivastava S, Garg J. Massive pregnancy gingival enlargement: A rare case. J Indian Soc Periodontol, 2013; 17(4):503-506.
5. Abhishek Singh Nayyar, Mubeen Khan, GT Subhas, B Nataraju, Vijayalakshmi KR and Raghvendra BM. Gingival Enlargement in Epileptic Patients on Phenytoin Therapy-An Evidence Based Approach. J Neurol Neurophysiol, Volume 3, Issue 2, 1000127
6. Ornella Florio Maysa Tfouni, Ivan Balducci et al. Nifedipine-induced gingival overgrowth, Braz Dent Sci 2012 out./dez.; 15 (4)

7. Craig S. Miller and Douglas D. Damm. Incidence of Verapamil-Induced Gingival Hyperplasia in a Dental Population, J Periodontol May 1992, Volume 63, Number 5.
8. R. A. Seymour, D. G. Smith and D. N. Turnbull. The effects of phenytoin and sodium valproate on the periodontal health of adult epileptic patients. Journal of Clinical Periodontology 1985: 12:413-19
9. Ellis JS, Seymour RA, Robertson P, Butler TJ, Thomason JM: Photographic scoring of gingival overgrowth. J Clin Periodontol 2001; 28: 81-85.
10. Arend Bokenkamp, Bettina Bohnhorst et al. Nifedipine aggravates cyclosporine A-induced gingival hyperplasia. Pediatric Nephrology April 1994, Volume 8, Issue 2, pp 181-185
11. Sofia Douzgou and Bruno Dallapiccola (2011). The Gingival Fibromatoses, Underlying Mechanisms of Epilepsy, Prof. Fatima Shad Kaneez (Ed.), ISBN: 978-953-307-765-9, InTech, Available from: <http://www.intechopen.com/books/underlying-mechanisms-of-epilepsy/the-gingival-fibromatoses>
12. Tim McGaw, Stephen Lam, Jim Coates. Cyclosporin-induced gingival overgrowth: Correlation with dental plaque scores, gingivitis scores, and cyclosporin levels in serum and saliva. Oral Surgery, Oral Medicine, Oral Pathology Volume 64, Issue 3, September 1987, Pages 293-297
13. Abdol Hamid Khoori, Behzad Einollahi, Ghassem Ansari, Mohammad Bagher Moozeh. The Effect of Cyclosporine with and without Nifedipine on Gingival Overgrowth in Renal Transplant Patients. J Can Dent Assoc 2003; 69(4):236-41
14. King. GN, Fullinfaw R, Higgins TJ, Walker RG, Francis DMA and Wiesenfeld D. Gingival hyperplasia in renal allograft recipients receiving cyclosporin-A and calcium antagonist, J Clin Periodontol. 1993. 20. 286-293
15. Prasad V N, Chawla H S, Goyal A, Gauba K, Singhi P. Folic Acid and Phenytoin Induced Gingival Overgrowth - Is There A Preventive Effect. J Indian Soc Pedo Prev Dent June (2004) 22 (2) 82-91
16. Ingle JI, Howard WL, Zwick HH. Effects of antihistaminic therapy on diphenylhydantoin sodium (Dilantin) gingival hyperplasia. J Am Dent Assoc 1959;58:63-71,
17. Eva Ingles, DDS, Jeffrey A. Rossmann, Raul G. Caffesse, Dr Odont. New clinical index for drug-induced gingival overgrowth. Quintessence internationa, Volume 30, Number 7,1999
18. Caroline H, Shiboski, Phyllis Kawada et al. Oral Disease Burden and Utilization of Dental Care Patterns Among Pediatric Solid Organ Transplant Recipients, J Public Health Dent. 2009; 69(1): 48-55.
19. Babcock J.R. and Nelson G.H. Gingival hyperplasia and dilantin content of saliva: a pilot study. J Am Dent Assoc 1964; 68: 195 -198.
20. Miranda J, Brunet L, Roset P, Berini L, Farre´ M, Mendieta C. Prevalence and Risk of Gingival Enlargement in Patients Treated With Nifedipine. J Periodontol 2001; 72: 605-611.

21. Kimball OP. The treatment of epilepsy with sodium diphenylhydantoinate. J Am Med Assoc 1939;112: 1244-1245.
22. Conard GJ, Jeffay H, Boshes L, Steinberg AD. Levels of 5, 5-diphenylhydantoin and its major metabolite in human serum, saliva and hyperplastic gingiva. J Dent Res 1974; 53:1323-1329.
23. Friskopp J, Klintmaltii G. Gingival enlargement: A comparison between cyclosporine and azathioprine treated renal allograft recipients. Swed Dent J 1986;10:85-92.
24. Daley TD, Wysocki GP, Day C. Clinical and pharmacologic correlations in cyclosporine-induced gingival hyperplasia. Oral Surg Oral Med Oral Pathol 1986;62: 417-421,
25. Barak S, Engelberg IS, Hiss J. Gingival hyperplasia caused by nifedipine. Histopathologic findings. J Periodontol 1987;58:639-642
26. Heijl L, Sundin Y. Nitrendipine-induced gingival overgrowth in dogs. J Periodontol 1988;60:104-112.
27. Pasqualin F, Bedeschi G, Boschiero L, Dean P, Piubello Q. Hiperpiasias gingivales por ciclosporina-A, Odontostomatoi Implantoprotesi 1990;5:319-322.
28. Kitamura K, Morisaki I, Adachi C, Kato K, Mihara J, Sobue S, Haniada S. Gingival overgrowth induced by cyclosporine A in rats. Arch Oral Biol 1990;35:483-486.
29. Hefti AF, Eshenaur AE, Hasseli TM, Stone C. Gingival overgrowth in cyclosporine A treated multiple scicrusis patients. J Periodontol 1994; 65:744-749.
30. Nery EB, Edson RG, Lee KK, Pruthi VK, Watson J. Prevalence of nifedipine-induced gingival hyperpiasia. J Periodontol 1995; 66:572-578.
31. O'Valle P, Mesa P, Aneiros, Gomez-Morales M, Lucena MA, Ramirez C, et al. Gingival overgrowth induced by nifedipine and cyclosporin A. Clinical and morphometric study with image analysis. J Clin Periodontol 1995; 22: 591-597.



**Source of support:** Nil

**Conflict of interest:** None declared

This work is licensed under CC BY: *Creative Commons Attribution 3.0 License*.