

An original procedure for the ovoid pontic technique in ortho-restorative cases

Originale utilizzo della tecnica ovoid pontic nei casi multidisciplinari

Received on 29 January 2021
Accepted on 21 May 2021

***Corresponding author**

Gianluca Mampieri
gianluca.mampieri@uniroma2.it
gianluca.mampieri@gmail.com

Gianluca Mampieri^{1*}
Roberta Condo²
Ercole Morucci³
Aldo Giancotti⁴

¹DDS, MS, PhD, Assistant Professor, Department of Clinical Sciences and Translational Medicine - University of Rome "Tor Vergata", Rome
²MD, DDS, Assistant Professor, Department of Clinical Sciences and Translational Medicine - University of Rome "Tor Vergata", Rome
³DDS, General Dentist in Bracciano, Rome
⁴DDS, MS, Assistant Professor, Department of Clinical Sciences and Translational Medicine - University of Rome "Tor Vergata", Rome

ABSTRACT

OBJECTIVES

In the multidisciplinary treatments, especially in case of missing teeth in aesthetic area, the compliance of patient during retention time post orthodontic therapy is evidently very high, even among teen patients, in particular when we adopt clear retainers comprising absent teeth.

The purpose of this paper is to show an original use of the ovoid pontic technique associated with retainers to model soft tissues and achieve an ideal emergence profile around pontic to give the illusion of a natural gingival margin around prosthodontic restoration.

MATERIALS AND METHODS

The ovoid pontic technique is a procedure developed to adapt the gingiva to the prosthodontic bridge element as naturally as possible.

The authors presented two clinical cases in which two different methods were utilized to perform ovoid pontic technique during retention time:

1. by means of the analogic technique, using a thermoformed 1.5 mm thick PETG essix;
2. by means of digital workflow, using a Vivera[®] retainer (Align Technology, San José, CA, USA).

The objective of the ovoid pontic technique is not only to achieve the ideal emergence profile around prosthodontic restorations but overall to avoid a traumatic second surgery to implement soft tissues. For this purpose is strategic to select patients with thick gingival tissues for obtaining best final results. A minimum thickness of 3 to 5 mm of soft tissue is required from the gingival crest to the alveolar ridge.

In both procedures, the pontic was gradually increased by using a light-cured biocompatible fluid composite to determine increasing pressure over the gingival tissue, modeling the edentulous area and finally leading to a natural look of the prosthodontic restoration. Then, a gradual and controlled hyperpressure can transform an unfavorable tissue configuration. There is also a possibility of closing undesirable interdental "black holes" through papilla "formation", by pressuring the gingival tissues.

CONCLUSIONS

The proposed method allows to manage gingival tissues during retention time, which is usually a passive phase of the orthodontic therapy, accelerating the treatment for the final restorative phase and improving the esthetic outcome.

In conclusion, according to the thermoformed retainer based ovoid pontic technique, orthodontists can manage gingival tissues on their own before referring the patient to a restorative dentistry specialist.

CLINICAL SIGNIFICANCE

This paper presents an original way of managing the ovoid pontic technique during the orthodontic retention time to accelerate the following restorative phase, allowing to take advantage from a passive treatment stage while conditioning soft tissues and thus limiting the aesthetic discomfort for the patient.

KEY WORDS

- Ovoid-pontic technique
- Customized treatment
- Esthetics
- Biomimetic
- Gingival tissue remodeling

RIASSUNTO

OBIETTIVI

Nei trattamenti multidisciplinari, specialmente in caso di assenza di denti anteriori, la collaborazione del paziente nella fase di mantenimento post-terapia ortodontica è molto alta, perfino tra i pazienti adolescenti, in special modo quando si utilizzano retainer che comprendono al loro interno i denti mancanti.

Lo scopo di questo lavoro è presentare un originale utilizzo della tecnica ovoid pontic abbinata ai retainer al fine di modellare i tessuti gengivali e ottenere un profilo di emergenza ideale attorno al restauro protesico per dare l'illusione di un margine gengivale naturale.

MATERIALI E METODI

La tecnica dell'ovoid pontic è una procedura sviluppata per adattare nella maniera più naturale possibile la gengiva della zona edentula all'elemento dentale intermedio di un ponte protesico.

Gli autori presentano due casi clinici dove sono stati utilizzati due diversi metodi per realizzare la tecnica dell'ovoid pontic nella fase di mantenimento post-ortodonzia:

1. tecnica analogica, usando un essix termostampato in PETG di 1,5 mm di spessore;
2. tecnica digitale, usando il retainer Vivera® (Align Technology, San José, CA, USA).

L'obiettivo della tecnica ovoid pontic non è solo quello di creare il profilo di emergenza ideale attorno al restauro protesico, ma soprattutto di evitare un secondo intervento chirurgico per l'incremento dei tessuti molli nella zona. A tal fine è strategico selezionare pazienti con tessuti gengivali spessi per ottenere i migliori risultati finali. Un minimo spessore da 3 a 5 mm di tessuto gengivale dalla cresta alveolare al margine gengivale è richiesto. In entrambe le procedure l'ovoid

pontic è stato realizzato attraverso un incremento graduale dell'elemento protesico intermedio con un composito fluido fotopolimerizzabile bio-compatibile che genera una crescente pressione sui tessuti gengivali dell'area edentula, modellandoli e, infine, ottenendo un profilo di emergenza protesico molto simile a un dente naturale. Quindi una graduale e controllata iperpressione può trasformare una configurazione tessutale poco favorevole. È possibile anche chiudere gli anti-estetici spazi neri interdentali tramite la generazione della papilla ottenuta con la compressione dei tessuti gengivali.

CONCLUSIONI

Il metodo proposto permette di modellare i tessuti gengivali della zona edentula durante il periodo passivo della stabilizzazione ortodontica post-trattamento, accelerando la successiva fase di restauro e migliorando l'estetica fi-

nale del risultato. Per concludere, secondo la tecnica dell'ovoid pontic applicata ai retainer l'ortodontista stesso può modellare i tessuti gengivali prima di inviare il paziente allo specialista in odontoiatria restaurativa per il restauro definitivo limitando così il suo disagio estetico.

SIGNIFICATO CLINICO

Questo lavoro presenta un'originale gestione della tecnica ovoid pontic durante il mantenimento ortodontico al fine di accelerare la successiva fase restaurativa, sfruttando il momento passivo di stabilizzazione post-terapia per condizionare i tessuti gengivali.

PAROLE CHIAVE

- Tecnica ovoid-pontic
- Trattamenti individualizzati
- Estetica
- Biomimetismo
- Rimodellamento tessuti gengivali

1. INTRODUCTION

It is very challenging to ensure that the gingiva around prosthodontic restorations has the same thickness and height as those around natural teeth. This is especially true in the anterior area, where any error is immediately visible. The ovoid or "egg-shaped" pontic is a technique used to create an illusion that the tooth is growing out of the gingiva.

The objective of the ovoid pontic technique is not only to achieve the ideal emergence profile around prosthodontic

restorations, according to the concepts of biomimetics, but also to avoid a traumatic second surgery to implement soft tissues.

The ovoid pontic technique changes the shape of the edentulous ridge with gradual pressure over the gingival tissues, improving esthetics and giving a natural look to prosthodontic restoration^[1].

The use of the ovoid pontic of the temporary prostheses for modeling soft tissues has been thoroughly described: the concept is that calibrated pressure is put on the soft tissues to

obtain the ideal emergence profile^[1-12].

The ovoid pontic technique features two options:

- if neighboring teeth are used as part of the restorative treatment, then a temporary tooth-supported fixed dental prosthesis will be used;
- if neighboring teeth are not involved in the treatment, a partial removable prosthesis could be adopted.

This type of partial prosthesis is less comfortable for the patient, but features the advantage of easy access and mani-

pulation, and does not involve aggression to neighboring teeth.

The technical procedure consists of gradually increasing, week by week, ovoid pontic volume of the temporary prostheses, by adding an easy-to-handle light-cured biocompatible material as compomers.

As a matter of fact, compomers are extremely biocompatible; indeed, they are used in class V restorations in contact with the gingiva. The shape and volume of the ovoid pontic shall be adapted to the needs of each particular case, and the weekly changes of the temporary prostheses ought to be adapted to the evolution of soft tissues. This means there is no standardized protocol indicating the procedure. Gradual, controlled hyper-pressure can modify an unfavorable tissue configuration, allowing a more natural, functional restoration.

In the past, clinicians believed that pressure over the residual ridge resulted in an inflammatory process. Some authors have shown that controlled hyper-pressure, applied with a convex and highly polished pontic, associated with rigid plaque control, only resulted in a thinning of the epithelium with no inflammation^[13,14].

Another scientific work demonstrated that the mucosa under the ovoid pontic remained healthy, independently from the pontic material, when dental floss was regularly used^[15].

A histological evaluation of the alveolar ridge mucosa adjacent to an ovoid pontic after 1 year showed that such sites were not associated with clinical signs of inflammation. The ovoid pontic progressively moves the connective tissue and the epithelium without damaging them. The pressure does not break the epithelial barrier, but models it^[16].

A minimum thickness of 3 to 5 mm of soft tissue is required to improve the final outcome^[13]. This measurement is taken from the gingival crest to the alveolar ridge. Optimal results are reached when pressure is applied to thick tissues^[13].

The aim of the article is to show how the orthodontist could play a strategic role in such treatments, managing soft tissues by means of a modified thermoformed retainer during retention time to improve esthetic outcome and predictability, as well as simplifying prosthodontic rehabilitation.

Two clinical cases, one with analogic and one with digital procedure, have shown how the mentioned technique can be used on young patients with agenesis after the completion of orthodontic space reopening. More specifically, the procedure is illustrated step-by-step.

2. MATERIALS AND METHODS

As reported, the ovoid pontic is a technique used to create the ideal emergence profile around prosthodontic restorations especially in edentulous areas.

The study has shown two patients, one with a fixed appliance and one with clear aligners, suggesting two methods to realize the ovoid-pontic during the retention phase of an orthodontic treatment, usually a passive stage in the multidisciplinary treatment:

- by means of an analogic technique, by using a thermoformed 1.5 mm thick PETG essix (Scheu Dental Duran, Iserlohn, Germania);
- by means of digital workflow, by using a Vivera® retainer (Align Technology, San José, CA, USA).

Vivera® is made of a mixture (EX40) characterized by a greater thickness and less

flexibility than the mixture used for aligners (EX30). These technical features guarantee more rigidity and stability to the structure of the Vivera® retainer, favoring long term retention.

For both procedures, the pontic is filled with a light-cured biocompatible fluid composite (Tetric EvoFlow, Ivoclar Vivadent Inc., AG Schaan, Liechtenstein) to create a temporary composite crown.

Clinical cases and procedure application

Case 1

Diagnosis and etiology

A 15 year-old male patient came to the orthodontic office with a bilateral Class I, agenesis of 1.2-4.2, deep bite and spaces in the upper arch (**fig. 1a-f**).

The radiographic examination confirmed the absence of 1.2 and 4.2. Moreover, element 2.2 was undersized and the upper midline was deviated towards the right. The radiographic and clinical examinations of the temporo-mandibular joints showed no alterations. Facial features consisted of a balanced profile with a retrognathic tendency.

Treatment plan

The main treatment objectives were:

- to align and level the dental arches;
- to manage spaces in the upper arch;
- to open space in position 1.2 and balance the space for 2.2 for restoration purposes;
- to correct deep bite;
- to shape soft tissue in edentulous area 1.2.

Orthodontic treatment progress

A bidimensional fixed appliance was placed in both the arches. The first phase consisted of leveling and aligning both arches. The following step



Figg. 1a-f Initial records

in the upper arch involved space opening for replacement of element 1.2 by using Ni-Ti open coil springs exerting 100 g on .16x.22 s.s. archwire. Subsequently, the required spaces mesial and distal to the undersized left lateral tooth were set for proper prosthetic rehabilitation.

In the lower arch, the absence of one incisor raised some difficulties while correcting deep bite due to incisor proclination and risks related to space reopening. However, working with full size .18x.22 s.s. archwire with an accentuated curve of Spee and with an increa-

sed lingual torque, a good result was achieved.

During the 20-month treatment, the patient was visited every four weeks in order to check biomechanics and oral hygiene.

Treatment results

The final records showed a good occlusal result with a proper bilateral Class I relationship and normalization of the overbite (**figg. 2a-c**).

Due to the agenesis of one lower incisor, the upper midline was centered in relation to the median lower incisor. How-

ever, the critical aspect of the described treatment was space management in the upper arch to allow for prosthodontic replacement of the missing lateral tooth (1.2) and space redistribution for esthetic restoration of tooth 2.2 by using veneers upon growth completion. Thus, the final result evidenced optimal space distribution for the subsequent restorative phase.

At the end of the orthodontic treatment, the innovative approach based on remodeling gingival tissues was initiated. In order to achieve a natural emergence profile from the gingiva, the retention phase



Fig. 2a-c Final records before prosthetic restoration

featured the management of the edentulous area by means of ovoid pontic of 1.2 within a thermoformed retainer.

Thanks to this procedure, passive retention time turned into an active treatment phase to accelerate the definite rehabilitation and, thus, to limit any potential psychological impact on the adolescent patient.

More specifically, a thermoformed retainer 1.5 mm thick with a temporary fluid composite crown in position 1.2 was developed by the laboratory. The retainer was thicker than usual to guarantee adequate stability and more pressure on the gingiva (**fig. 3**).

Thus, the provisional element included within the retainer would have gradually changed and molded gingival tissues in order to increasingly achieve an ideal

emergence profile. Moreover, the pressure on the soft tissues was exerted in such a way to avoid being harmful, in order to preserve the integrity of the epi-

thelium. For this reason, the ideal volume increment should not have been greater than 1-1.5 mm per week. In addition, the controlled pressure exerted on the cen-



Fig. 3 Thermoformed retainer 1.5 mm thick with a temporary resin crown in 1.2 position



Fig. 4a, b After discarded by a dedicated bur the epithelium on the edentulous area is conditioned by using retainer with ovoid-pontics

tral area of the edentulous mucosa would contribute to the generation of papillae between the ovoid pontic and the adjacent teeth.

After a 3-week period meant to verify patient compliance, the gingival tissue management phase started. On one hand, the technical procedure consisted of gradually increasing and polishing, week after week, the root of temporary element 1.2 inside the retainer, by adding an easy-to-handle light-cured biocompatible fluid composite. In addition, especially at the beginning, the epithe-

lium on the edentulous area was meant to be slightly discarded.

The final result shows a natural emergence profile around prosthodontic restoration inside retainer (**fig. 4a, b**). Soft tissues were well adapted to the pontic and no inflammation was detected.

After three months of stabilization, it was possible to proceed with definitive prosthodontic rehabilitation. As planned, a single-wing lithium disilicate Maryland adhesive bridge was cemented for missing lateral replacement. Hence, the internal surface of lithium disilicate fra-

meworks was etched with hydrofluoric acid, treated with a silane coupling agent, and bonded with an adhesive resin cement (**fig. 5**).

Case 2

Diagnosis and etiology

A 13 year-old male patient came to the orthodontic clinic with a Class II subdivision, absence of 3.1, deep bite and altered upper gingival smile line (**figg. 6a-e**). The radiographic examination confirmed the agenesis of 3.1. (**fig. 7**) The radiographic and clinical examinations of temporo-mandibular joints showed no alterations. Facial features consisted of a balanced profile with a retrognathic tendency.

Treatment plan

The main treatment objectives were:

- to align and level the dental arches;
- to correct right Class II relationship;
- to correct deep bite;
- to open space in position 3.1;
- to shape soft tissue in area 3.1.

Orthodontic treatment progress

The case was treated by means of Invisalign Technique. The correction occurred by using 51 aligners. The finishing



Fig. 5 Final result with the cemented single-wing lithium disilicate Maryland bridge



Fig. 6a-e Initial records



Fig. 7 Pre-treatment panoramic x-ray

phase was not required thanks to an accurate treatment plan of dental movements based on the Clincheck Pro simulation.

The Class II relationship was corrected by sequential distalization, distal rotation of upper molars, transverse coordination of both arches and upper incisor retraction with intrusion and increased palatal torque.

Treatment results

After 18 months of treatment, all objectives set in the planning phase were achieved (fig. 8a-f).

The Class II malocclusion had been completely corrected; proper overbite and overjet were achieved. The space for 3.1 was optimized as expected, comparing the virtual and the real outcomes.

The patient was given 3 sets of aligners at a time, and was seen every 6 weeks to check aligners' fit and integrity of the attachments.



Figg. 8a-f Final records post-orthodontic treatment

At the end of the orthodontic treatment, the approach to remodel gingival tissues was initiated. In this case, the management of the edentulous area was realized by ovoid pontic of 3.1 within a retainer with a pure digital workflow (**figg. 9a, b**).

Retainer of Align is composed of a mixture (EX40) and is characterized by a rigid and stable structure. Such features are essential not only to maintain orthodontic results but also to allow for constant pressure on the gingiva in order to

condition it and to achieve a natural emergence profile from the gingiva around 3.1.

Digital prescription for retainer allows to plan a pontic in the edentulous area of 3.1. Successively, the pontic is filled with a light-cured biocompatible fluid composite to simulate a natural tooth.

As shown in the previous clinical case, the composite of the pontic is modeled in excess and then polished so as to form a sort of root which gradually presses on the edentulous area, mol-

ding gingival tissues and achieving an ideal emergence profile in a few weeks.

Ideal volume increment was set as 1.5 mm per week by adding biocompatible flow composite, but the initial epithelium on the edentulous area had to be slightly discarded by a dedicated bur to obtain more natural results. The frenectomy of the lower lip was also performed (**figg. 10a, b**).

The final result shows a natural emergence profile around the pontic, with well



Fig. 9a, b Composite of the pontic is modeled in excess and then polished



Fig. 10a, b Epithelium on the edentulous area is slightly discarded by a dedicated bur; frenectomy of the lower lip was also performed

adapted soft tissues and no inflammation in the 3.1 area (**fig. 11**).

Because of the patient's young age (14.6) definitive prosthodontic rehabilitation by means of a single-wing lithium disilicate Maryland adhesive bridge or an osteointegrated implant would be scheduled no sooner than in 2 years' time.

3. DISCUSSION

The ovoid pontic technique is a procedure developed to adapt the gingiva to

the prosthodontic bridge element as naturally as possible.

The retention phase in an orthodontic treatment is a passive stage in which the clinician monitors and assesses result stabilization.

In case of missing teeth in the aesthetic area, we have observed that patient compliance is evidently very high, even among teen patients, especially when we adopt clear retainers comprising absent teeth.

Strategically, it can be helpful to take

advantage of this to manage gingival tissues to simplify and/or accelerate the following prosthodontic phase. If good quality and quantity of gingival tissues are identified, management thereof can be easily and successfully achieved by the dentist.

The procedure accurately replicates the prosthodontic one with removable partial skeletal prosthesis, yet, in this case, a more comfortable and esthetic thermoformed retainer was successfully used.



Fig. 11 Epithelium in the ovoid area is healthy and without signs of inflammation

For this article, we have selected patients with thick gingival tissues. A minimum thickness of 3 to 5 mm of soft tissue is required from the gingival crest to the alveolar ridge to obtain best results.

From our point of view, simplicity and ductility of the mentioned technique allows it to be used even in case of patients with edentulous areas characterized by a thin gingiva after regenerative surgery to increase the thickness of gingival tissues, as in cases of free connective tissue grafts or roll-flap technique^[17-20]. Obviously, to this aim, studies shall be designed evaluating the clinical outcome with objective measurements.

4. CONCLUSIONS

A strategic aspect of multidisciplinary treatments is to coordinate the operative sequence to have rapid and smooth workflow. Esthetic, functional and hygienic requirements of an artificial tooth in a fixed partial denture can be achieved using the ovoid pontic technique. The procedure of the ovoid pontic by thermoformed retainers implies two advantages:

- to manage gingival tissues during retention time, accelerating the overall treatment;
- to improve esthetic results.

If the patient is carefully selected with thick and healthy gingival tissues, even the orthodontist can successfully perform an ovoid pontic procedure, transforming the passive phase of retention into an active phase of treatment.

Such procedure is recommended for the replacement of missing teeth in the esthetic area or for patients with a high smile line. Moreover, the ovoid pontic creates an illusion of a free gingival margin and interdental papilla, minimizing black triangles. The mentioned aspects are very important when there are esthetic challenges to face, as in case of missing anterior teeth.

In conclusion, according to the thermoformed retainer based ovoid pontic technique, orthodontists can manage gingival tissues on their own before referring the patient to a restorative dentistry specialist. ■

CONFLICT OF INTEREST

The authors confirm that there are no known conflicts of interest associated with this publication.

FUNDING FOR THE STUDY

The authors did not have significant financial support for this work that could have influenced its outcome.

INFORMED CONSENT

For the publication of the case, including photos, the consent of the patient was obtained.

REFERENCES

1. **Miller MB.** Ovate pontics: the natural tooth replacement. *Pract Periodontics Aesthet Dent* 1996 Mar;8(2):140.
2. **Edelhoff D, Spiekermann H, Yildirim M.** A review of esthetic pontic design options. *Quintessence Int* 2002 Nov-Dec;33(10):736-46.
3. **Liu CL.** Use of a modified ovate pontic in areas of ridge defects: a report of two cases. *J Esthet Restor Dent* 2004;16(5):273-81.
4. **Dylina TJ.** Contour determination for ovate pontics. *J Prosthet Dent* 1999 Aug;82(2):136-42.
5. **Grunder U, Spielmann HP, Gaberthüel T.** Implant-supported single tooth replacement in the aesthetic region: a complex challenge. *Pract Periodontics Aesthet Dent* 1996 Nov-Dec;8(9):835-42.
6. **Yang Y, Cui FJ, Liu XQ, Pu TT, Zhou JF, Tan JG.** Effect of provisional restorations with ovate pontics on preservation of the ridge after tooth extraction: case series. *Chin J Dent Res* 2019;22(3):181-8.
7. **Bakshi M, Tarnow D, Bittner N.** Changes in ridge dimension with pontics immediately placed at extraction sites: a pilot study. *Int J Periodontics Restorative Dent* 2018 Jul/Aug;38(4):541-7.
8. **Bhandari S.** Clinical outcome of tooth-supported fixed partial dentures in unilateral cleft lip and palate patients: a case series. *J Indian Prosthodont Soc* 2017 Jan-Mar;17(1):68-73.
9. **Narayan SJ, Singh PK, Devarhubli AR, Keerthi R.** Soft tissue development around pontic site: a case series. *J Indian Prosthodont Soc* 2016 Jul-Sep;16(3):298-302.
10. **Lee JH, Lee CH.** Completely digital approach to an ovate pontic. *J Prosthet Dent* 2016 Jun;115(6):792-4.
11. **Guruprasada.** Creating natural gingival profiles of missing anterior teeth using ovate pontic. *Med J Armed Forces India* 2015 Jul;71(Suppl. 1):S124-6.
12. **Yang Y, Cui FJ, Liu XQ, Pu TT, Zhou JF, Tan JG.** Effect of provisional restorations with ovate pontics on preservation of the ridge after tooth extraction: case series. *Chin J Dent Res* 2019;22(3):181-8.
13. **Jacques L, Borges Coelho A, Hollweg H, Conti PC.** Tissue sculpturing: an alternative method for improving esthetics of anterior fixed prosthodontics. *J Prosthet Dent* 1999 May;81(5):630-3.
14. **Tripodakis AP, Constantinides A.** Tissue response under hyperpressure from convex pontics. *Int J Periodontics Restorative Dent* 1990;10(5):408-14.
15. **Tolboe H, Isidor F, Budtz-Jorgenson E, Kaaber S.** Influence of pontic material on alveolar mucosal conditions. *Scand J Dent Res* 1988 Oct;96(5):442-7.
16. **Zitzmann NU, et al.** The ovate pontic design: a histologic observation in humans. *J Prosthet Dent* 2002 Oct;88(4):375-80.
17. **Saqui SA, Bhat MYS, Javali MA, Shamsuddin SV, Kader MA.** Modified roll technique for soft tissue augmentation in prosthetic rehabilitation: a case report. *Clin Pract* 2019 Mar 14;9(1):1110.
18. **Thoma DS, Buranawat B, Hämmerle CH, Held U, Jung RE.** Efficacy of soft tissue augmentation around dental implants and in partially edentulous areas: a systematic review. *J Clin Periodontol* 2014 Apr;41(Suppl 15):S77-91.
19. **Zucchelli G, Mazzotti C, Bentivogli V, Mounssif I, Marzadori M, Monaco C.** The connective tissue platform technique for soft tissue augmentation. *Int J Periodontics Restorative Dent* 2012 Dec;32(6):665-75.
20. **Thoma DS, Benic GI, Zwahlen M, Hämmerle CH, Jung RE.** A systematic review assessing soft tissue augmentation techniques. *Clin Oral Implants Res* 2009 Sep;20(Suppl 4):146-65.