

module1

ANATOMY OF THE CERVIX, SQUAMOCOLUMNAR JUNCTION, METAPLASTIC CHANGE AND TRANSFORMATION ZONE

Comprehensive Visual Inspection of the Cervix with Acetic Acid (VIA) and Lugol's Iodine (VIL)
<http://www.gfmer.ch/vic/>

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Learning objectives

Recognize the anatomical and histological landmarks of the cervix.

Define the squamocolumnar junction (*SCJ*) and transformation zone (*TZ*).

Understand the changes that occur during the reproductive life and the metaplastic process (*transformation process*).

Consider SCJ and TZ as fundamental dynamic landmarks of the transformation process and origin of precancerous lesions (*CIN*) and cancer.

Anatomy of the cervix

The **cervix** represents the lower cylindrical distal portion of the uterus and is divided into:

ectocervix / endocervix

The portion of the cervix projecting into the vagina is called *portio vaginalis* (*3cm length*).

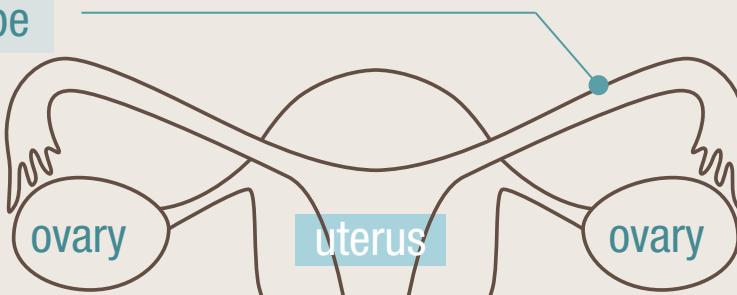
The ectocervix - portio vaginalis - is visible during a speculum examination (*fig. 1*).

The cervix opens onto the vagina through an orifice called the *external os* (*fig. 1*).

Anatomy of the cervix

Fig. 1

Fallopian tube



IO

Endocervix

SCJ

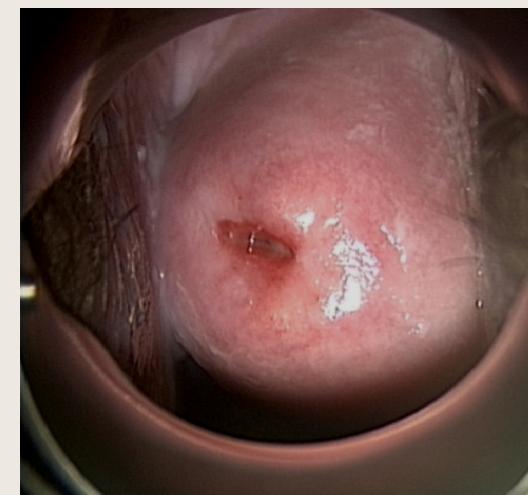
EO Vagina

EO: external os,

IO: internal os,

SCJ: squamocolumnar junction

Ectocervix – portio vaginalis
and external os (EO) during
the vaginal examination



Anatomy of the cervix

The **endocervix** (*endocervical canal*) is a luminal cavity within the cervix forming a passageway between the external os and the internal os.

The upper limit of the endocervical canal called the internal os or **isthmus**, marks the transition from the endocervix to the endometrium (*uterine cavity*) (fig.1).

The endocervical canal has a fusiform shape and measures 7 to 8 mm at its widest in reproductive-aged women.

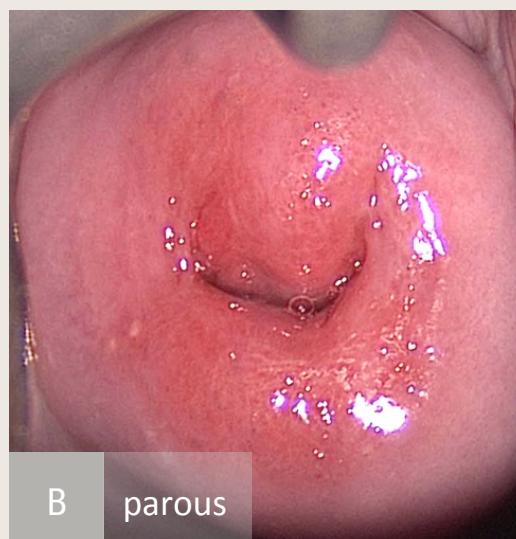
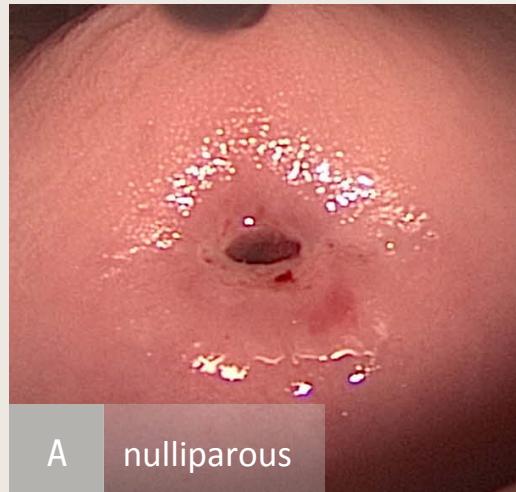
Anatomy of the cervix

Fig. 2

The size and shape of the cervix vary widely with age, hormonal state, and parity.

In the nulliparous female it is barrel shaped with a small circular external os at the center of the cervix. (fig. 2a).

In parous women, cervix is bulky and the external os becomes slit-like (fig. 2b).



Histology of the normal cervix

The **ectocervix** is covered by non-keratinizing, stratified **squamous** epithelium, either native or metaplastic in continuity with the vaginal epithelium.

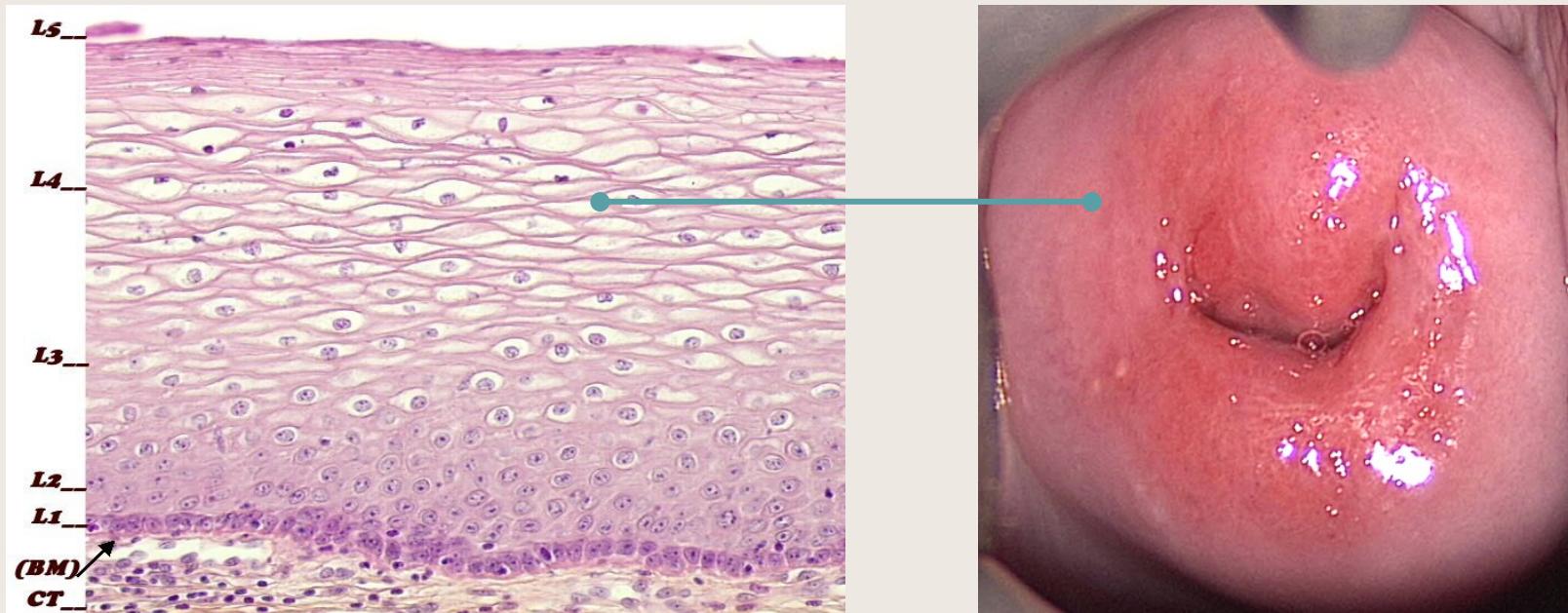
The squamous epithelium is composed by multiple layers: basal, parabasal, intermediate and superficial layer (*fig. 3*).

The **endocervix** is lined by a simple columnar epithelium that secretes mucus.

Mucinous columnar epithelium lines the surface and the underlying glands (*fig. 4*).

Histology of the normal cervix: Ectocervix

Fig. 3

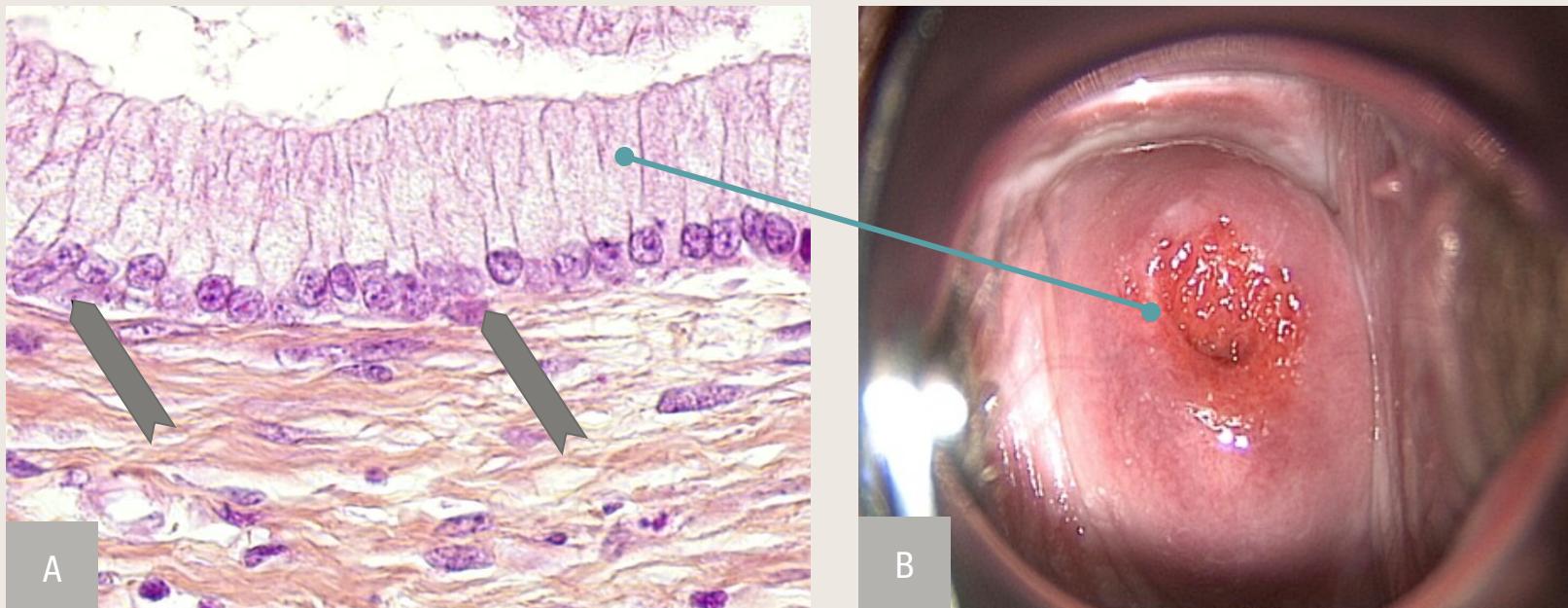


Structure of the ectocervix: *CT*=connective tissue, *BM*=basement membrane, *L1*=basal cells (1 layer), *L2*=parabasal cells (2 layers), *L3*=intermediate cells (around 8 layers), *L4*=superficial cells (5 or 6 layers) and *L5*=exfoliating cells.

Courtesy of IARC: <http://screening.iarc.fr>

Histology of the normal cervix: Endocervix

Fig. 4



Normal endocervix: the columnar epithelium is composed of one layer of mucin secreting cells with few reserve cells (black arrow) – fig. 4a. Ectropion allowing the visualization of columnar epithelium – fig. 4b

Courtesy of IARC: <http://screening.iarc.fr>

Histology of the normal cervix: Squamo- columnar junction

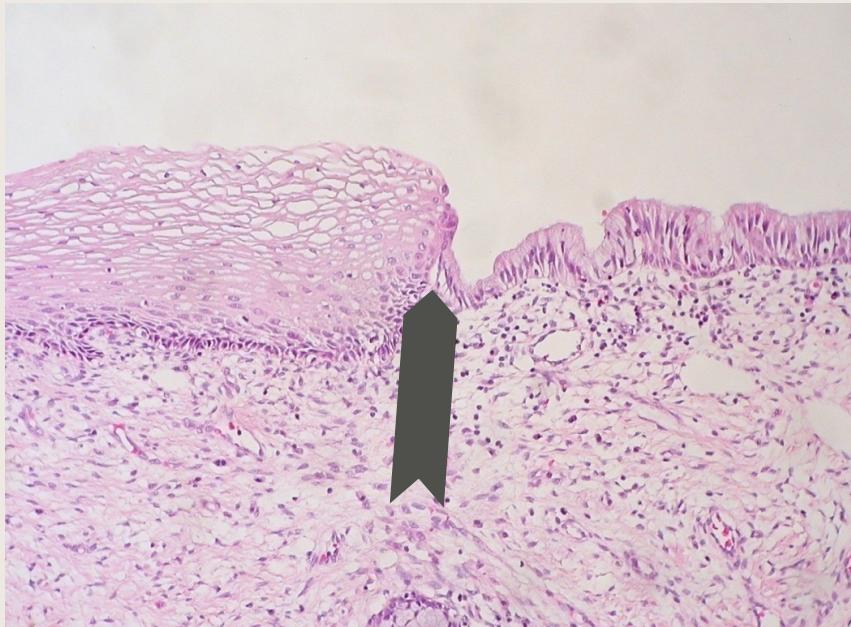
The squamocolumnar junction (SCJ) (fig.5) is defined as the junction between the squamous epithelium and the columnar epithelium. Its location on the cervix is variable.

The SCJ is the result of a continuous remodeling process resulting from uterine growth, cervical enlargement and hormonal status.

During this process the original SCJ everts along with large portions of columnar epithelium from their initial position onto the ectocervix.

Histology of the normal cervix: Squamocolumnar junction

Fig. 5



The squamocolumnar junction: marks the boundary between the squamous-lined ectocervix and the columnar-lined endocervix (arrows)

Pathological and histological images: Courtesy of Ed Uthman at Flickr

Histology of the normal cervix: Squamo- columnar junction

Age and hormonal status are the most important factors influencing location of SCJ.

At birth and during premenarchal years, the SCJ is located at or very close to the external os (*original SCJ*).

During reproductive age, the SCJ is located at variable distances from the external os.

In a postmenopausal woman, the new SCJ is not visible and has receded into the endocervix.

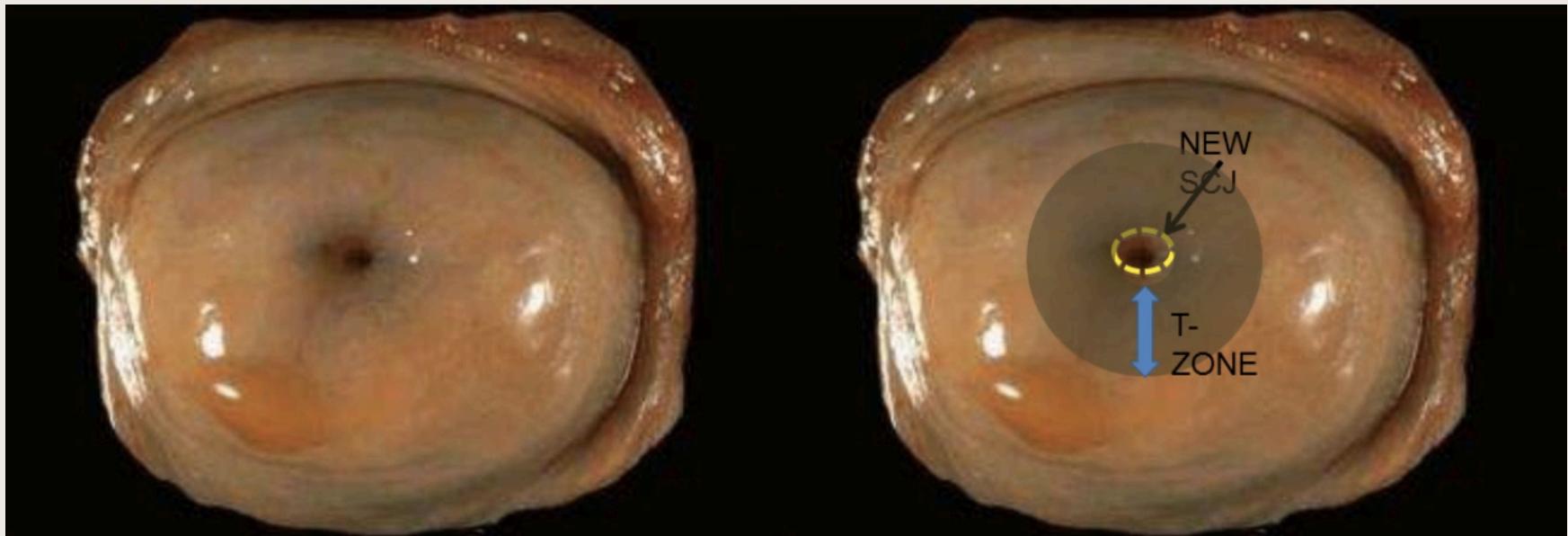
Ectropion

An eversion onto the ectocervix of the SCJ along with large portions of columnar epithelium is referred to as an **ectropion** (*fig. 6 and animation*).

Progressively through a process called metaplasia the ectropion is **replaced** by metaplastic squamous epithelium (*fig. 7 - 8 and animation*).

Metaplasia is a reaction of the exposed everted columnar epithelium (*ectropion*) to irritation by **acidic vaginal environment**.

SCJ and TZ: Fundamental dynamic landmarks of the transformation process

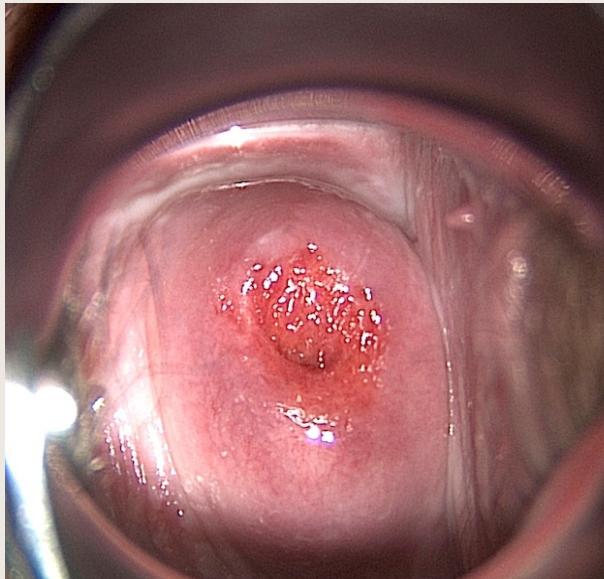


Surgical specimen: courtesy of Dr C. Achtari (CHUV), Lausanne

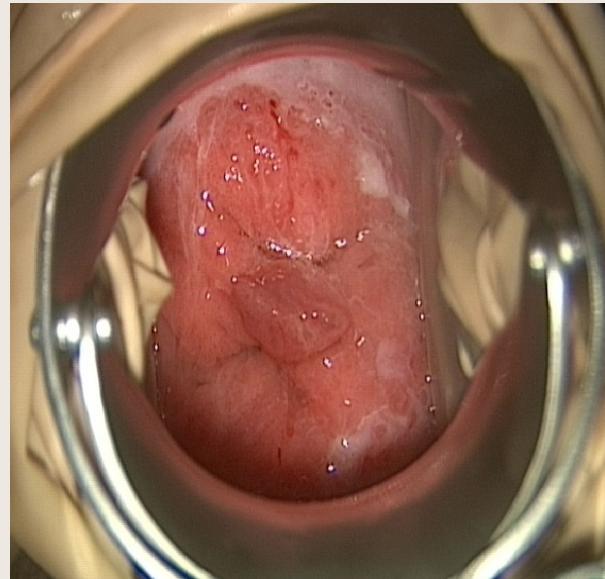
Pictures: Pierre Vassilakos, GFMER, Geneva / Dominique Ricard-Gauthier, medical student HUG, Geneva

Ectropion: Eversion of the columnar epithelium

Fig. 6



Ectropion: the columnar endocervical epithelium is visible on the surface of the cervix



Large ectropion: with cervical polype covering the external os

Histology of the normal cervix: Squamous metaplasia

Metaplasia is a non-neoplastic transformation of one mature cell type to another mature cell type that is not normally present at that location.

The metaplastic process of the cervix starts with the appearance of **subcolumnar reserve cells** of the endocervical epithelium (*fig. 4a*).

These cells proliferate and form a thin layer of immature squamous cells without stratification or glycogen (**immature squamous metaplasia**) (*fig. 7a*).

Histology of the normal cervix: Squamous metaplasia

The immature metaplasia then differentiates into mature stratified squamous epithelium (**mature squamous metaplasia**).

The mature squamous metaplasia is similar to the normal glycogen containing original squamous epithelium (*fig. 7b*).

Both mature and immature metaplasia might be observed on the cervix at the same time.

Histology of the normal cervix: Squamous metaplasia

Fig. 7A

Immature squamous metaplasia
after proliferation of reserve cells.
Remaining endocervical cells on the
surface.

7A

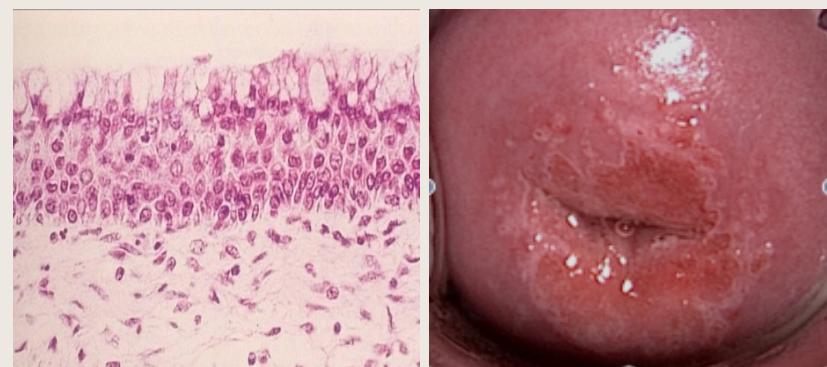


Fig. 7B

Mature squamous metaplasia (a)
identical to the native squamous
epithelium (b)

7B



The transformation zone (TZ)

Transformation zone (TZ) (*fig. 7, 8 and animation*): Area between the original SCJ and the new SCJ where the columnar epithelium (*ectropion*) has been replaced and/or is being replaced by the new metaplastic squamous epithelium.

The TZ may be either wide or narrow depending on age, parity, prior infections and exposure to female hormones.

The new squamocolumnar junction

As a result of the metaplastic process a **new SCJ** is formed. It is visible as a distinct **white line** after the application of 3 to 5% **acetic acid**.

The white aspect after acetic acid application (*fig.7a, fig.8a*) is due to the presence of **immature** squamous metaplastic epithelium adjacent to the new SCJ.

The cervical area between the old SCJ and the new SCJ is referred to as the **transformation zone** (*TZ fig.8b*).

Transformation zone (TZ)

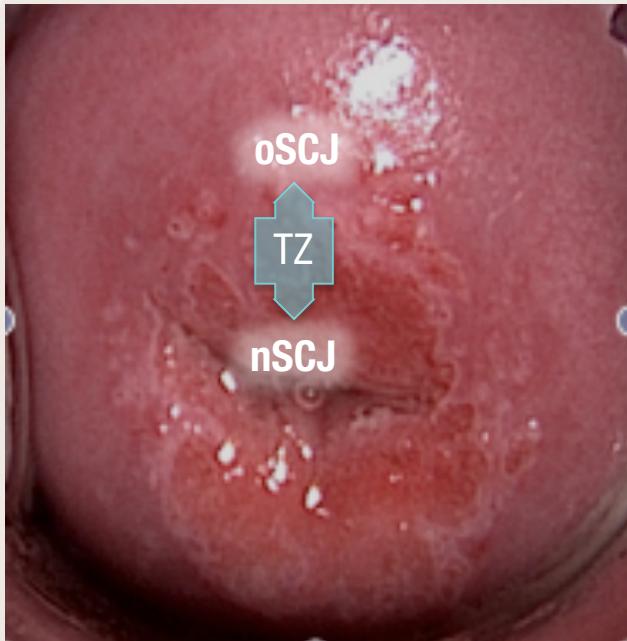


Fig. 8A

Observe the immature metaplasia present in the transformation zone

oSCJ – old squamocolumnar junction
nSCJ – new squamocolumnar junction

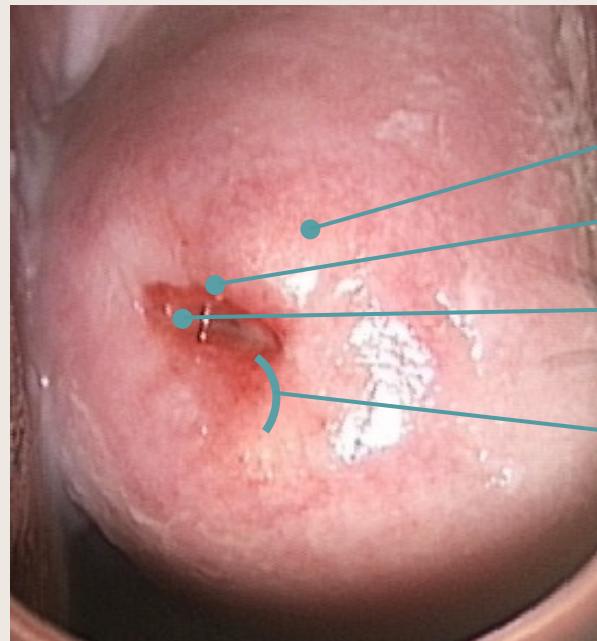
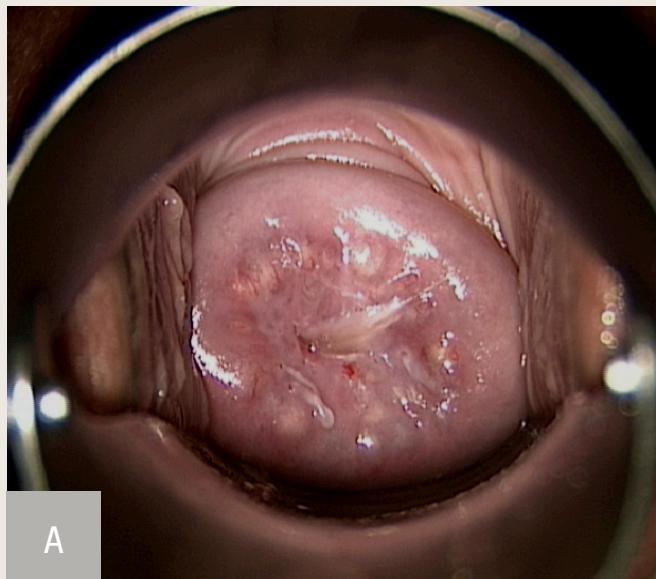


Fig. 8B

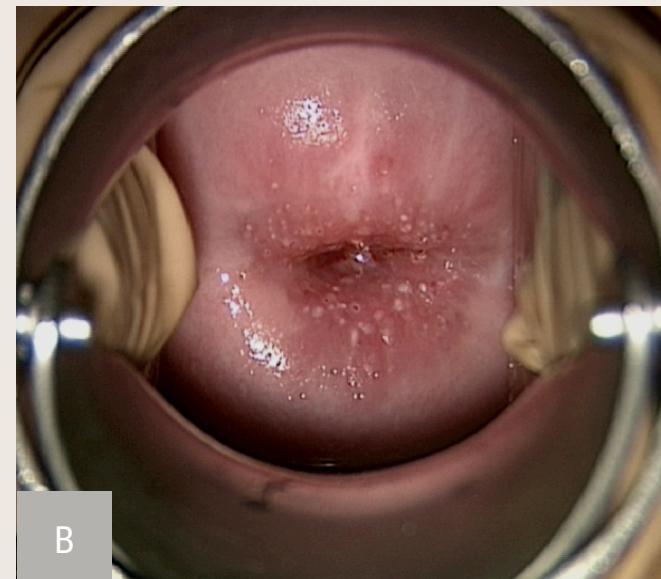
Once the metaplastic epithelium is mature, its aspect will be identical to the original squamous epithelium

Nabothian cysts and glandular orifices

Nabothian cysts and fine glandular orifices are normal findings in a transformation zone. They appear when metaplasia fails to progress into the glandular crypts.



A



B

Nabothian cysts (a): the metaplastic process fails to enter the crypts covering them only at the surface. The mucus of endocervical crypts accumulates creating a typical cyst aspect.

The fine glandular orifices (b): the metaplastic process fails to descend or cover the crypts of the columnar epithelium. Therefore the orifices of the crypts remain visible.

Why are SCJ and TZ important ?

Recent studies indicate SCJ to be a site of “**embryonic cell population**”, with a «top-down» pattern of differentiation.

In this model, the **reserve cells** are the progeny of embryonic cells with different susceptibilities to infection by **HPV** and therefore involved in malignant transformation.

The **TZ** is the site of origin for **> 90%** of precancerous lesions also called squamous intraepithelial lesions (**CIN**) and cancers.

Conclusion

The SCJ and TZ are fundamental dynamic landmarks of the transformation process (metaplasia).

Age and hormonal status are the most important factors influencing the location of SCJ on the cervix.

HPV infections affecting the transformation zone may lead malignant transformation (CIN) and cancer.

Identification of the SCJ and TZ is crucial when performing a VIA/VILI examination.