

## Chapter

## 1

## Basic principles of colposcopy

Atypical cervical cytology or positive test for high-risk human papilloma virus (hrHPV), especially if it is persistent, may indicate the presence of abnormality on the cervix. Naked eye visualization will only detect invasive disease but cannot differentiate preinvasive disease from the normal cervix. In this situation colposcopic examination is important.

### Indications for colposcopy

Ideally all women with abnormal cervical cytology and/or positive hrHPV should undergo colposcopic assessment to identify those with and those without any clinically visible lesions. This allows clinical verification of the cervical cytology and hrHPV report. In those with an atypical lesion, the colposcope can aid diagnosis and management as appropriate. In those women where no atypical lesions are visualized, they can have a less stringent follow-up schedule often in the community setting.

Indications for colposcopy:

- Borderline (atypical squamous cells of undetermined significance, ASC-US) nuclear abnormalities on three occasions or single ASC-US with positive hrHPV test as triage.
- Mildly dyskaryotic cytology (low-grade squamous intraepithelial lesion, LSIL) with positive hrHPV test as triage if available. If HPV testing is not available, then referral after two consecutive mildly dyskaryotic cytology samples (LSIL) is acceptable practice.
- Moderate or severe dyskaryosis (high-grade squamous intraepithelial lesion, HSIL), with or without hrHPV status.
- Cytology suggestive of malignancy.
- Glandular abnormalities, irrespective of severity.
- Any degree of cytological abnormality or hrHPV positivity in women who have previously undergone treatment for cervical intraepithelial neoplasia (CIN).
- Repeated (three consecutive) unsatisfactory cervical cytology reports.
- Post-coital bleeding after age 40 if cancer suspected.
- Intermenstrual bleeding or persistent vaginal discharge if cancer suspected.
- Suspicious cervix suggestive of malignancy regardless of the cytology report. This may include an abnormal feeling cervix on bimanual examination.
- Lesions affecting the cervix e.g. condyloma acuminata which may have associated preinvasive or invasive disease.
- Repeated inflammatory cervical cytology.

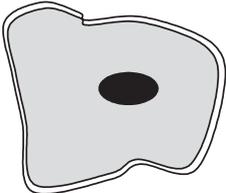
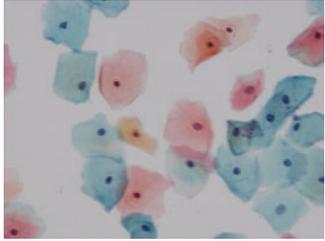
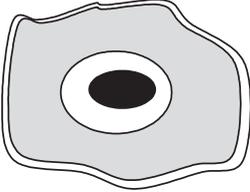
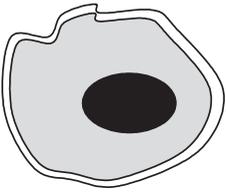
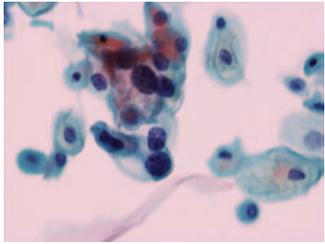
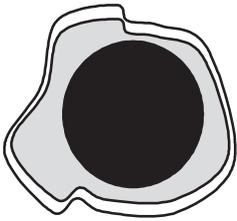
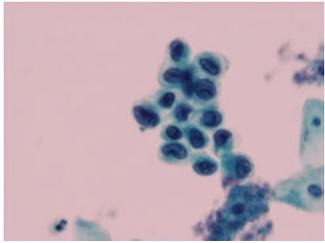
Dyskaryosis or dysplasia on a cervical cytology sample refers to disproportionate nuclear enlargement in the cell in comparison to the amount of cytoplasm present. Dyskaryotic cells have abnormal chromatin content and distribution and may have abnormality in the nuclear shape.

Prior to the colposcopic examination, a relevant medical history should be obtained, ideally using a proforma designed specifically for the colposcopy clinic. Information should be obtained in relation to menstruation, contraception, pregnancies, smoking, previous cervical cytology, symptoms, previous treatments, and date of last menstrual period. A detailed explanation should be given to the patient with regards to the colposcopic examination. Written information should be given prior to the visit to the colposcopy department.

The colposcope is a binocular microscope that allows magnification and illumination of the cervix. By applying various stains to the cervix, abnormalities can be identified. These include benign, precancerous, and malignant changes. Its primary use is to evaluate abnormal cervical cytology as an aid to diagnosis. It can then be used to guide further management.

All colposcopes follow similar principles. They provide magnification between 6- and 40-fold. Low and

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<p><b>Fig 1.1</b> Normal cells contain plentiful cytoplasm and regular nucleus.</p>		
<p><b>Fig 1.2</b> Koilocytosis, which may occur in all grades of cytological abnormality as perinuclear vacuolation.</p>		
<p><b>Fig 1.3</b> Increased nuclear size in relation to cytoplasm consistent with low-grade changes (mild dyskaryosis).</p>		
<p><b>Fig 1.4</b> High-grade dyskaryosis (moderate or severe dyskaryosis) – note the considerably increased nuclear/cytoplasm ratio.</p>		

medium magnification is used for initial assessment; high magnification (20-fold plus) is used to detect the finer detail of vascular patterns. A green filter allows better visualisation of vasculature on the cervix.

Colposcopy is best carried out on days 10–14 of the menstrual cycle when the cervical mucus is clear and not tenacious. Colposcopic assessment is difficult when there is significant vaginal bleeding. If the woman is menstruating, the procedure should be postponed.

If the presenting symptoms were of vaginal bleeding in the presence of a suspicious looking cervix, then the woman should be seen irrespective of bleeding status to rule out the possibility of invasive disease. Common sense needs to prevail in scheduling the appointment. Women taking the oral contraceptive pill can continue with this to allow colposcopic assessment to take place for the convenience of the woman and the clinic.

## How to choose a colposcope

There are a variety of colposcopes available. Only by trialling some of these colposcopes will the correct decision be made in terms of choosing the right colposcopic equipment for your particular environment. Some of the criteria that should be assessed are:

- Cost – can vary considerably. Affordability is one of the most important factors in decision making.
- Optical quality – the better the optics, the better the colposcopic image. This relates to brightness, clarity, and an evenly illuminated image.
- Zoom magnification – there should be a good range of magnifications available. Most have a stepped magnification although some have a continuously variable mechanism.
- Design should allow the colposcopic arm to be counter-balanced to ensure smooth movement and stability in usage.
- Eyepiece – should feel comfortable in usage. Many have diopter adjustment for visual correction of myopia (short sightedness) and hypermetropia (long sightedness).
- Focal length – usually fixed, although in some may be variable to a degree, which allows the colposcopist to be optimally positioned for the procedure.
- Illumination – should have good even light with facility for green filter. The bulb should be easily changeable.
- Fixtures – can be free standing, wall, ceiling or chair mounted depending on the clinical



Fig 1.5 Colposcope.

environment. Size and maneuverability may be important if the colposcope is to be used in more than one setting.

- Operating environment – make sure that colposcope will function given the clinic air temperature and humidity level.
- Optional accessories:
  - Display facilities – by attaching to a monitor, live images can be displayed for education and teaching functions. Otherwise a teaching arm is useful.
  - Recording facilities – documentation is becoming increasingly important and digital formats are ideal for this purpose. One can either use still or video formats.

## The following instruments should be available

- Examination gloves.
- Cervical sampling devices – cervical brushes (e.g. cytobrush, cervix brush), spatulae (e.g. Ayre's, Aylebury's, or plastic spatula).
- Container for liquid-based cytology; glass slides (plus fixative) for traditional cytology.
- Bivalve speculum of varying size and lubricant.
- Three small pots containing saline, acetic acid (3–5%), and Lugol's iodine.
- Cotton wool balls.
- Sponge holding forceps.
- Cotton-tip and jumbo swabs.
- Endocervical canal specula.
- Biopsy forceps and pots with fixative for specimens.
- Haemostatic solutions/substances – e.g. Monsel's solution (ferrous subsulphate) dried to a thick paste or silver nitrate sticks.



Fig 1.6 Colposcopy trolley.

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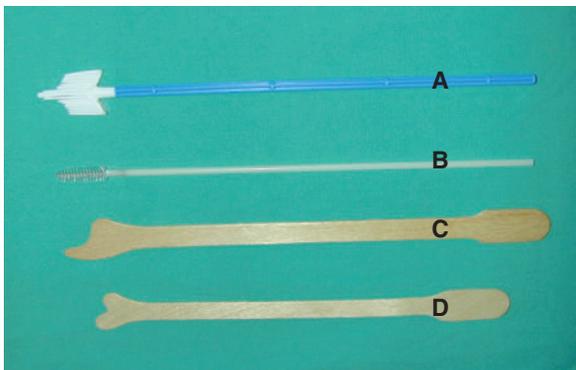
### Technique of colposcopy

Patients should be examined in warm relaxed surroundings having been fully informed about the procedure. The woman is helped onto the couch in the lithotomy position. Leg supports should be comfortable and the couch adjusted appropriately. External genitalia should be assessed for any obvious abnormalities. A suitably sized speculum is used to expose the cervix. If the vaginal sidewalls obstruct the view, they can be displaced by using the finger of an examination glove (or a condom) placed over the speculum blades.

If required a cervical cytology sample is taken but if the woman is presenting with cytological



**Fig 1.7** Variety of speculae in large, medium, and small size. Bivalve with screw and lever for opening speculum.



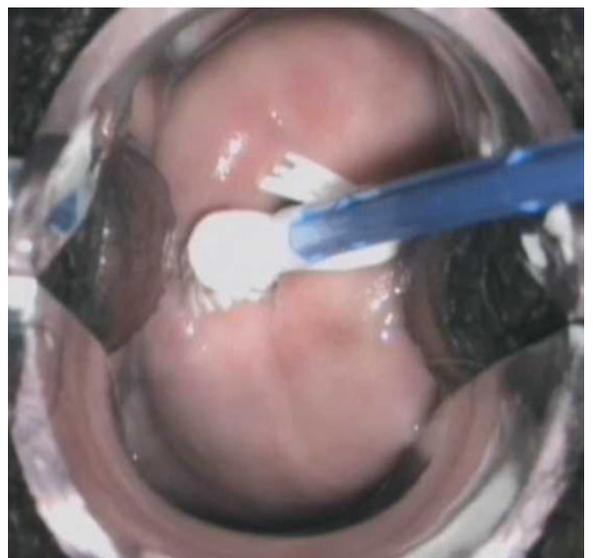
**Fig 1.8** Various sampling devices for taking cervical cytology – cervix brush (A), cytobrush (B), Aylesbury spatula (C), Ayres spatula (D).

abnormality, this should be avoided as it can cause unnecessary bleeding and interference with the colposcopic examination. A variety of sampling devices are available.

Liquid-based cytology relies on the sampler being either immersed or agitated in fixative fluid (rinse using a vigorous swirling motion and then push the brush into the bottom of the vial at least ten times forcing the bristles apart). The cervical brushes are ideal for this purpose because some of these have detachable ends. Certain plastic spatulas also have detachable ends for this purpose. To obtain the cytology sample, the Cervex brush is rotated clockwise five times after being applied to the cervix. Where sampling of the endocervix is important, then a cytobrush should be used additionally. If a Papanicolaou smear (Pap smear) is required, then this may be obtained by the use of wooden/plastic spatulae or cervical brushes.

If a cervical cytology sample is required, this should be taken before the application of acetic acid. Occasionally, if one forgets and acetic acid is applied before taking the cervical sample, then this should be annotated on the cytology request form.

The cervix and upper vagina are examined at low magnification. Any excess mucus or blood should be removed using a dry or saline-soaked cotton wool ball. Presence of gross lesions and leukoplakia should be identified. The green filter should be used to assess the vascular pattern (low to high power). Benign lesions

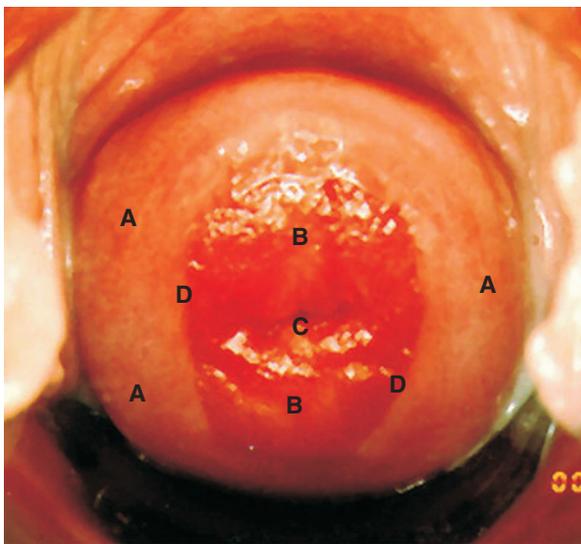


**Fig 1.9** Cervix brush being used for cytology sample taking.

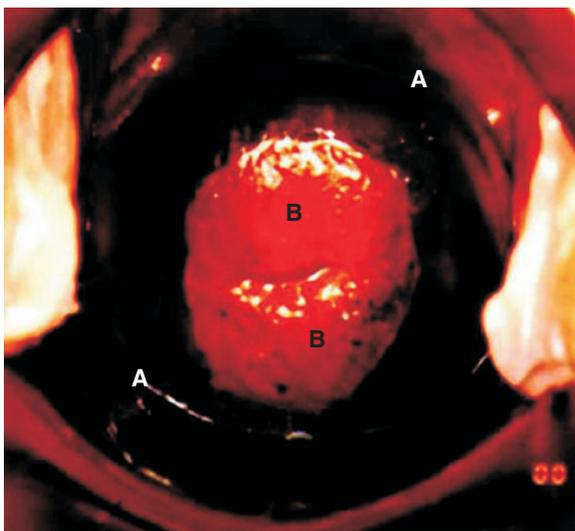
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that are visualized should be noted. These include Nabothian follicles, cervical polyps, warts, cysts etc.

Acetic acid (3–5%) is gently applied to the cervix with saturated cotton wool balls on sponge forceps or a jumbo swab, or by using a spray or syringe. Unnecessary abrasion should be avoided. The acetic acid is left in contact with the cervix for 10 seconds.



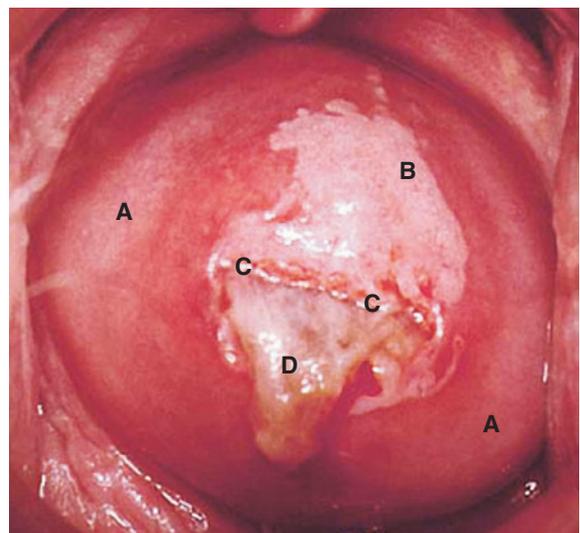
**Fig 1.10** Normal cervix with ectropion squamous epithelium (A) surrounds columnar epithelium (B) and cervical canal (C). Junction between the two types of epithelia is the SCJ (D).



**Fig 1.11** Normal cervix with application of Lugol's iodine. Columnar epithelium (B) with minimal stain surrounded by glycogenated normal squamous epithelium (A), which stains darkly.

Following acetic acid application, any remaining mucus may be removed easily. Further acetic acid is applied as necessary. The cervical landmarks and any atypical areas should be mentally mapped. If image recording facilities are available, then these should be used liberally and stored either digitally or in print format. Lugol's iodine (1% iodine, 2% potassium iodide, 97% distilled water) may be used to further delineate atypical epithelium that contains little or no glycogen and therefore fails to take up the iodine stain. Normal squamous epithelium turns mahogany brown with Lugol's iodine. Columnar epithelium also contains little or no glycogen and fails to take up the stain. This is referred to as 'Schiller's test'. A positive Schiller's test refers to non-staining (i.e. iodine negative) and vice versa. Any excess solutions are removed from the vagina prior to removal of the speculum. The vagina should be examined as the speculum is removed. Immediately following assessment, the findings are recorded, ideally in a standard format.

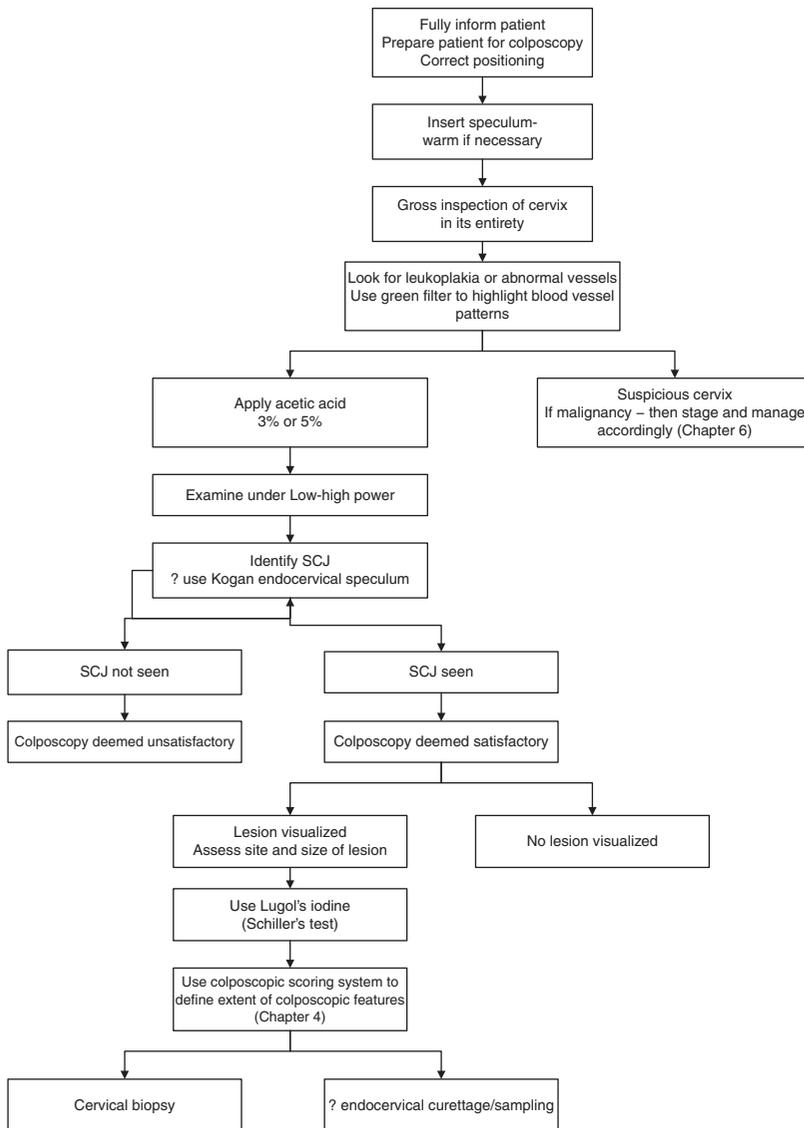
- Was the squamocolumnar junction visible?
- Was there any acetowhite epithelium? If yes, document its site and size in graphic format (see Chapters 2 and 4).
- Assess the degree of change (see Chapter 4).



**Fig 1.12** Cervix following application of acetic acid. Squamous epithelium (A), acetowhite changes with sharp border (B), cervical canal and SCJ (C), cervical mucus – viscid following acetic acid application (D).

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Fig 1.13 Colposcopy flowchart.



### Learning points

- Colposcopy is appropriate in women with cytological abnormality.
- Women attending for colposcopy should be adequately informed and counseled.
- Dedicated facilities for colposcopy are ideal with appropriate back-up facilities.
- There needs to be good communication channels between the cytology, colposcopy, and histopathology services.
- Saline, acetic acid, and Lugol's iodine are used sequentially and changes on the cervix noted.
- Accurate documentation is necessary and this can be facilitated with the use of a proforma.
- Digital image storage is recommended or other form of image capture.

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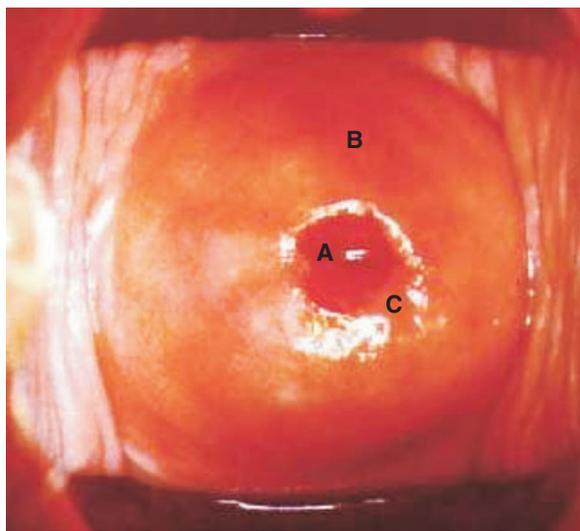
## 2

## The normal cervix and colposcopic appearance

A detailed knowledge of the normal appearance of the cervix is important prior to looking for colposcopic abnormalities. The size and shape of the cervix shows considerable variation amongst individuals and at different stages of an individual's life. Puberty and pregnancy in particular have significant effects on the cervix. Menopause may cause atrophic changes, which may lead to specific changes that may cause difficulties with screening and colposcopy.

In the adult, the cervix measures 2.5–3 cm in length. In the nulliparous, the external cervical os is circular whereas the multiparous cervix is slit-like in the transverse dimension. The cervix contains two types of epithelia, the stratified squamous, which lines the vaginal portion (ectocervix), and the simple columnar lining the cervical canal (endocervix), which is flattened in the anteroposterior dimension.

The understanding of the appearance and the relationship of the different epithelia types is described.



**Fig 2.1** Normal nulliparous cervix. Columnar epithelium (A) surrounded by squamous epithelium (B). Border between two epithelial types is the SCJ (C).

### Squamous epithelium

Two types of squamous epithelia may be present – original or transformed. The original squamous epithelium is a featureless smooth, pink epithelium originally established on the cervix and vagina. Squamous epithelium is similar to that found in the rest of the vagina and is multilayered. The epithelium does not stain white after the application of a dilute solution of acetic acid and stains brown after the application of Lugol's iodine.

In the transformed squamous epithelium, gland openings may be visualized on colposcopic assessment. If these gland openings become blocked for various reasons, then Nabothian follicles could be present.

### Columnar epithelium

Columnar epithelium is a single-layer, mucus-producing epithelium that extends between the endometrium cranially and either the original squamous epithelium or the metaplastic (transformed) squamous epithelium caudally. Columnar epithelium is normally present in the endocervix and may be present on the ectocervix (ectopy) or, on rare occasions, in the vagina. The epithelium appears red and velvety, contrasting with the pink squamous epithelium. Each villi that



**Fig 2.2** Normal cervix in parous woman. Cervical os appears slit-like.

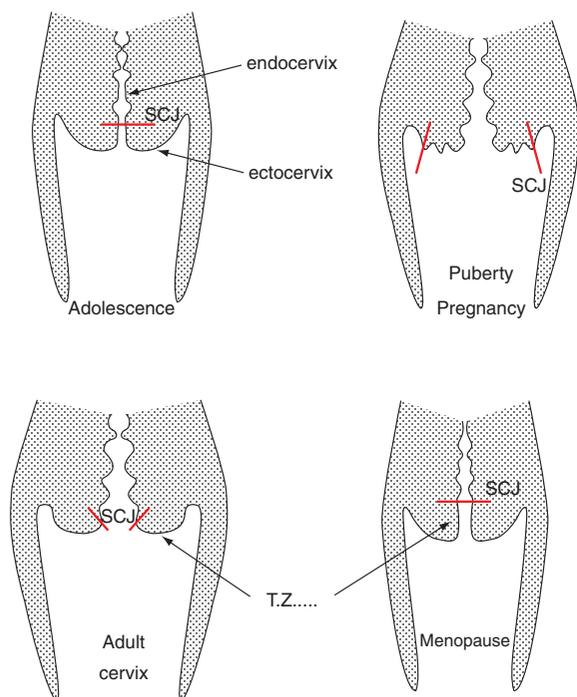
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gives it a characteristic appearance has a central blood supply.

At colposcopy the area has a typical grape-like structure. Application of acetic acid causes columnar epithelium to turn white and the villi become less distinct. As the epithelium is thin with blood vessels just below, contact bleeding may occur.

### Squamocolumnar junction

The squamocolumnar junction (SCJ) of the cervix is defined as the border between the stratified squamous



**Fig 2.3** The apparent migration of the SCJ secondary to hormonal influence.

epithelium and the mucin-secreting columnar epithelium of the endocervix. Two types of SCJ are described:

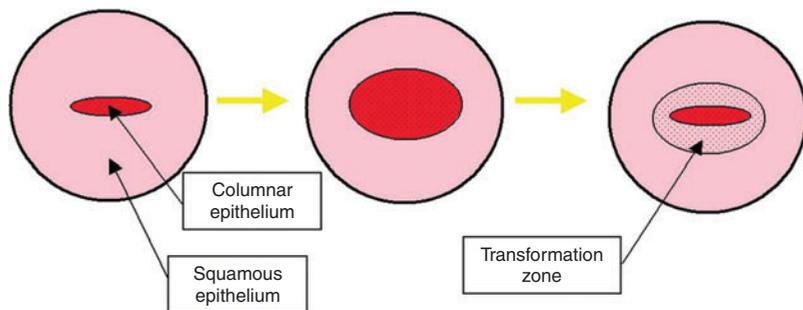
The *original* SCJ – site where the native squamous and columnar epithelia meet each other. This is present from birth. The exact location of the SCJ varies between individuals and at various stages in an individual's life.

At the time of menarche, both the cervix and uterus enlarge. This enlargement causes an eversion of the cervix so that more of the columnar epithelium is visible on the vaginal surface of the cervix. As the environment in the vagina is different from the endocervix, especially high acidity, the epithelium undergoes a process of transformation – metaplasia – and eventually is replaced by the stratified multilayered squamous epithelium. This gives rise to an acquired or *new* SCJ.

The *new* SCJ is at the junction of the metaplastic area and the columnar epithelium. This is an important landmark and is relevant for the full assessment of the transformation zone (TZ).

### Metaplasia

This is the physiological replacement of one type of mature epithelium by another equally mature type of epithelium. In the cervix, squamous metaplasia is the replacement of the mucin-secreting columnar epithelium by a stratified squamous epithelium. Varying stages from immature to mature metaplasia may be recognized on colposcopic assessment. The metaplastic process is irreversible and maximal during times of high estrogenic stimulation. These occur mainly during adolescence, whilst taking the combined oral contraceptive, and during the first pregnancy. It is important not to confuse the immature metaplastic process with abnormality.



**Fig 2.4** Process of metaplasia.

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Colposcopic features suggestive of metaplastic change:

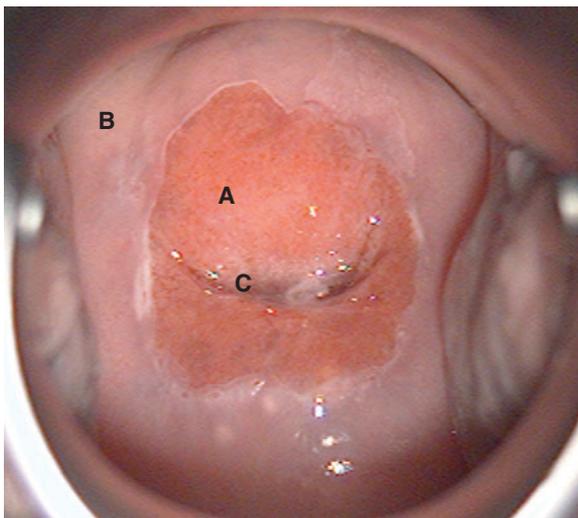
- Smooth surface with fine, uniform-caliber vessels
- Mild acetowhite change
- Negative or partial positivity with Lugol's iodine

### The transformation zone

The transformation zone (TZ) is the area between the original squamous and columnar epithelium within which varying degrees of maturity may be identified. The TZ is of variable shape and size. At different stages of maturity the metaplastic epithelium may stain slightly white after the application of acetic acid and partially brown after the application of Lugol's iodine. Components of a normal TZ may be islands of columnar epithelium surrounded by metaplastic squamous epithelium, cleft openings and Nabothian cysts.

There are three types of TZ:

- A type 1 TZ is completely ectocervical and fully visible, and may be small or large.
- A type 2 TZ has an endocervical component, is fully visible, and may have an ectocervical component that may be small or large.
- A type 3 TZ has an endocervical component that is not fully visible and may have an ectocervical component that may be small or large.

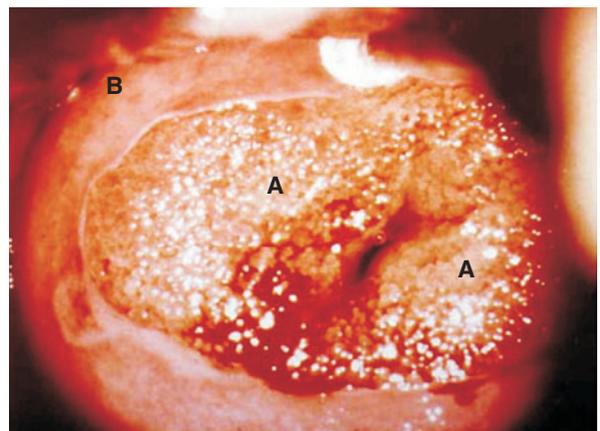


**Fig 2.5** Normal cervix with cervical ectropion. Columnar epithelium (A) and squamous epithelium (B), cervical canal (C).

In a small percentage of women the TZ may extend caudally onto the upper vagina, usually with an anterior and posterior triangle or tongue; it may contain a fine regular mosaic pattern of blood vessels and stain partially or wholly negative after the application of Lugol's iodine.

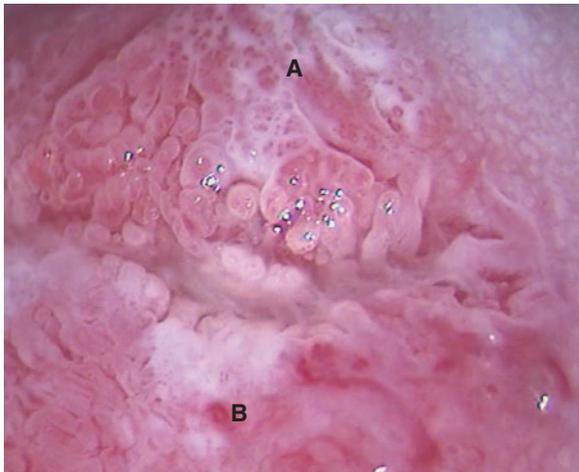
### Ectropion

This relates to the eversion of the columnar epithelium so that it is visible in the vaginal portion of the cervix. Although a physiological phenomenon, it can cause confusion in colposcopic assessment, especially if large and fragile. Ectropions can cause symptoms of vaginal discharge (excess mucin secretion) or postcoital bleeding (contact bleeding from fragile thin columnar epithelium). Cervical ectropion does not warrant any treatment unless there are related symptoms. Before undertaking treatment it is advisable to rule out an infectious cause such as chlamydia. If ablative treatment is undertaken, it is important to have a normal cervical cytology history and even biopsy if there is clinical suspicion. Cryocautery is the commonest method of treating ectropion as it can be conducted in clinic without recourse to anesthesia and has relatively high success rates. An alternative method is diathermy ablation for which local anesthesia is recommended. If necessary, treatment can be repeated in those with continuing symptoms.



**Fig 2.6** Large cervical ectropion. Large area of columnar epithelium (A) exposed and surrounded by squamous epithelium (B).

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**Fig 2.7** Metaplastic changes (A) within the TZ. Gland openings (B).

### Pathophysiology at different stages in a woman's life

At birth, most females will have some degree of mucin-secreting columnar epithelium present on the vaginal portion of the cervix. At about one year of age, the cervix begins to elongate and causes the SCJ to move towards the external os.

After menarche, a cervical ectropion is present by the eversion of the columnar epithelium onto the vaginal portion of the cervix. This undergoes physiologic metaplasia to squamous epithelium. These

changes are maximal under the age of 20 and during first pregnancy.

At the menopause, there is inversion of the cervix. This makes access to the TZ difficult. Cervical cytology and colposcopy is more likely to be unsatisfactory as the area of concern may be within the endocervix to varying degrees. A short course of estrogen may reverse these changes allowing better cytological and colposcopic assessment.

### Learning points

- Recognition of normality and its variations is important for colposcopy.
- The cervix is dynamic, undergoing changes from fetus until old age.
- Metaplasia and the replacement of columnar by squamous epithelium is a normal, irreversible, physiological process.
- Sampling from the TZ by cytology and its assessment by colposcopy varies according to the age of the woman.
- Columnar epithelium is single layered and allows visualization of vasculature beneath the epithelium (appears red).
- Squamous epithelium is multilayered and appears pink on examination.
- Recognition of the TZ and its varying stages of metaplasia is important for colposcopic practice.