Forensic Science In Sexual Offence Investigations
Overview of Presentation

• Forensic Examinations

• Case Assessment and Interpretation
Evidence types

- Semen
- Vaginal cells
- Saliva
- Faecal material
- Urine
- ‘touch’ DNA
- Hairs
- Damage
- Blood
  - Menstrual
  - Assault
- Lubricants
- Toxicology
Detection of semen

Visual
Dry – white and crusty
Liquid – opaque, highly viscous solution
Crimescope – semen stains can fluoresce

Presumptive chemical test:
AP reagent

Confirmatory test:
Microscopic examination and identification of sperm
Acid Phosphatase

- high levels in seminal fluid.

**AP test:**

- Sensitive

- Can detect invisible stains

- Water soluble
  Washing removes AP activity
Forensic Examinations

• Blotting paper pressed onto items – wetted and sprayed with chemical reagent used to detect acid phosphatase

- AP hydrolyses sodium α-naphthol phosphate
  
  Napthol + Brentamine black K Salt

  → = purple colour

• Colour change within 2 minutes
• Area testing positive is cut out and extracted.
False Positives

Vaginal fluid
- pink
- bacteria – blue/grey

Faeces and urine
- purple

Vegetable extracts
- Cauliflower, sprouts – pink/brown

Tea
- strong purple

Perfumes
- strong purple
Microscopic examination

cytoplasm → nucleus
Sperm density scores

Trace  (less than 10 spermatozoa found)
+      (spermatozoa are difficult to find)
++     (some spermatozoa in some fields – easy to find)
+++    (some spermatozoa in every field – easy to find)
+++++  (large quantity of spermatozoa in every field)

Also note presence of tails
No sperm heads - Why?

Positive AP

• Aspermic (no sperm cells)
• Oligospermic (low sperm count)
• Use of spermicide
• Use of a contraceptives e.g. Condoms

Negative AP

• No ejaculation onto area examined
• Incident did not occur as alleged
Florence Iodine

- Identifies presence of choline found in high levels in seminal fluid
- Choline is water soluble – not detected after washing
- Not as sensitive as AP & cannot be used for screening

False Positives

Small number of food stuffs

Did not react with any other body fluid
Persistence of semen following vaginal intercourse

Semen on vaginal swabs following full internal ejaculation:

- Should be found within 24 hours after intercourse
- May be found up to 3 days
- Occasionally found up to 7 days
- Can persist longer in cervix
- Samples taken up to 7 days

Depends factors such as degradation, activity accelerates vaginal drainage, washing, injuries etc
Persistence of semen following anal intercourse

Semen on anal swabs following full internal ejaculation:

- Should be found within 24 hours after intercourse
- Occasionally found up to 3 days
- Samples taken up to 3 days

Depends on factors such as degradation, activity, injuries, defecation

Also want vaginal swabs to address anal intercourse
Persistence of semen following oral intercourse

- Samples taken up to 2 days
- Unlikely to detect semen on oral samples after about 12 hours
- Early Evidence Kits!!

Depends on factors such as eating, drinking, swallowing
Vaginal Material

- Important when allegation of any insertion into the vagina during a sexual assault:
  - Penile
    - Penile swabs
    - Underwear (>24hrs)
  - Digital
    - Finger/hand swabs
  - Inserted items
  - Condoms
Forensic Examinations

Vaginal cells

- No screening or confirmatory test
- Can carry out a microscopic examination for cells of the type lining the vagina, on items such as penile swabs, underwear and condoms
- However, vaginal cells look similar to cells lining other body orifices such as mouth, anus, urethra
- Needs to be interpreted within context of case
Important in oral intercourse allegations

Chemical presumptive test for presence of amylase – component of saliva – **Phadebas test**

False positives
  - Faecal material
  - Vaginal secretions
  - Urine
  - Sweat

False Negatives!!!

No confirmatory tests at present – cells appear identical to vaginal, anal, urethra cells
Forensic Examinations

Phadebas paper

Starch cross-linked to a blue dye

Amylase breaks down the starch and releases the blue dye

Blue colour developed within 5 minutes - “In my opinion saliva most likely present”
Phadebas tube test

Positive control       Strong positive sample     Negative control

Positive control       Weak positive sample      Negative control
Persistence of Complainants DNA on Penile swabs

• Samples taken up to 3 days

• Most likely to obtain a DNA profile from the complainant within the first 12 hours of oral/vaginal intercourse

• After this, we would consider suspect’s underwear

• Depends on factors such as washing, wiping, degradation

• Low expectation of cells transfer following anal intercourse
Faeces & urine

- Faeces important for anal allegations
- Urination onto victim by offender
- Visual – ‘Sniff’ test – Chemical test
- Low DNA yield
‘Touch’ DNA

- Transfer of DNA to an item or person through skin contact

- Tape lifts, minitapes & swabs

- Areas to target?

- Detection of DNA through touch depends on
  - Retention capabilities of item
  - Duration and nature of contact
  - ‘Shedability’ of offender

- Direct v’s secondary transfer
Detection of male DNA on IP vaginal swabs

- Y-STR profiling
- Targeting male DNA on the Y chromosome
- Digital and penile penetration without ejaculation
- Time limit increase up to 48 hours
- Not compatible with NDNAD
- Lower evidential value
Damage

• Cause? Torn/ripped, cut or general wear and tear? Force?
• Recent? Wearable?
• Characteristic features under low power microscopy
• Target for ‘touch’ DNA
Blood

- Visual examination for red/brown staining
- Chemical testing: Kastle-Meyer (KM) – two stage reaction, pink
- Menstrual blood cannot be distinguished from traumatic blood.
Case Assessment

• Important to carry out for EVERY case

• From information received we can determine:
  
  – Expectations of findings
    • What is your aim/purpose of examination
    • What findings would you would expect given the victim and suspect versions of events
    • Ensures that evaluation of the case is not findings led

  - Staged examinations
    • Exhibit likely to provide best evidence
    • Saving time and money

LGC Classification: PROTECT
Information

- Our case assessment can only be as good as the information we receive

- Information required
  - Precise circumstances of allegation
  - Suspect version of events
  - Consensual/social contact leading up to and during incident?
  - Post incident actions
  - Clothing or bedding seized? Washed?
  - Menstruation/Injury?
  - Previous intercourse eg with a partner
  - Time of allegation
  - Time of medical
Medex forms

- All questions have a Y/N or N/A option so all should be answered
- Previous intercourse
- Shows all samples taken, not just those received
- Time and date
- Actions since alleged incident
- General injuries
- Body charts
- Use of speculum / proctoscope
Previous social contact

- DNA can be transferred through social contact
  - Allegation of digital penetration
  - Previous social contact including kissing,
  - suspect denied allegation but said he had cuddled her
  - Hand swabs from suspect and complainant’s knickers recovered
  - Is it worth examining them?
  - What is the significance of finding a DNA transfer?
Post Incident actions

Washing

• People:
  – Removes body fluids and DNA from skin, orifices and from under fingernails
  – But...showering, bathing or douching etc may have different effects

• Clothing:
  – AP is water soluble – removed by washing
  – We can still find sperm cells even if washed in a machine & redistribution can occur
  – Hand washing/no detergent is less effective
Sperm transfer in washing machine

- Child alleges step father has been having vaginal intercourse with her
- All underwear has been washed
- AP test for 10 mins – negative
- Extracted crotch area – trace semen – profile matches S
  From drainage? Crime related???

-Extracted other areas of the knickers – trace semen – profile matches S
  Unable to attribute trace of semen to criminal activity
Post Incident actions

Urination/defecation
• Allegations of anal intercourse
• Wiping

Eating/drinking
• Oral intercourse

Active?
• Drainage
Recent sexual history

- Semen / DNA can persist for days
- May decide a different strategy:
  - Separating swabs
  - Sex since the alleged rape – look at the knickers worn directly after incident not the swabs?
  - Could look at penile swabs / underpants of partner for offender’s semen and vice versa
  - Bedding
- If previous sexual history is known can eliminate previous partner (if reference sample provided)
Partners semen on suspects penile swabs

- IP alleged vaginal intercourse without her consent – ejaculation unknown.
- Suspect no comment
- Vaginal swabs taken within five hours
- IP had vaginal intercourse with partner three days prior to incident
  - Internal ejaculation
  - Has showered twice
- Expectation of getting semen from partner on vaginal swabs – moderate
- Expectation of getting semen from suspect on vaginal swabs – unknown
- Found semen from partner
- Penile swabs from suspect taken within 6 hours – trace semen – matched victims partner
Time Since Intercourse

The interval between intercourse taking place and when the evidence is seized, e.g., time of medical examination.

- The greater the time delay, the less likely you are to find semen.

- Factors that affect TSI findings:
  - Anything that accelerates drainage
  - Washing – external swabs, clothing
  - Natural degradation

- Effectiveness of sampling plays a role.
Time Since Intercourse

- we need to consider the persistence of seminal components:

**acid phosphatase**
- Vagina – 2-3 days
- Anus – 1 day
- Mouth – less than 1 day
- Clothing – until washed

**spermatozoa**
- Vagina – up to 7 days
- Anus – up to 3 days
- Mouth – up to 24 hours
- Clothing – indefinitely?? Washing may not remove all sperm.

LGC Classification: PROTECT
Time Since Intercourse

- Longer TSI the less the concentration of sperm

  - Trace  (less than 10 spermatozoa found)
  - +  (spermatozoa are difficult to find)
  - ++  (some spermatozoa in some fields – easy to find)
  - +++  (spermatozoa in every field – easy to find)
  - ++++  (large quantity of spermatozoa in every field)

LGC Classification:  PROTECT
Time Since Intercourse case example

• IP alleges that her partner has had vaginal intercourse with her against her consent on 18.8.15 (Tuesday)

• Suspect states he had vaginal intercourse with her on the 15.8.15 with internal ejaculation (Saturday)

• Vaginal swabs taken on the 19.8.15 – less than 24 hrs after the alleged incident and up to 96 hours after ‘consensual’ activity
Findings

HVS – AP positive & 4+ heads
LVS – AP positive & 4+ heads
Vulval – AP positive & 2+ heads

• In my opinion the findings are what I would expect if intercourse with ejaculation took place on the place 18.8.15 rather than on the 15.8.15

• Swabs taken in correct order?

• Speculum used?
Findings

HVS – AP negative & trace heads
LVS – AP negative & 1+ heads
Vulval – AP negative & no heads

• In my opinion the findings are what I would expect if intercourse with full ejaculation took place on the place 15.8.15 rather than on the 18.8.15

• Can’t discount that intercourse also took place on the 18.8.15 but without internal ejaculation
Case Assessment and Strategy setting
Case Assessment and strategy setting

Allegation
Suspect had vaginal i/c without victim’s consent on 11 June at 23.00 hours

Suspect’s version
He had consensual vaginal i/c with complainer on the evening of 3 June, no intercourse occurred on 11 June

Samples
High vaginal swabs – taken 14 hrs after alleged incident
Penile swabs – taken 15 hours after alleged incident

LGC Classification: PROTECT
Questions and Answers

- Did V say S ejaculated? No
- Does S state ejaculation occurred on 3rd June? - Yes
- Condom worn? No
- V and/or S washed prior to samples taken? No
- Underwear from either party seized? Yes both
- Recent intercourse? No
- V menstruating? No
- Injuries to either party? No
- Does S admit to any other contact with V after the 3rd June? No
- Has V been active? Yes
Expectations of detecting suspects semen on vaginal swabs?

- LR = Hp/Hd (prosecution/defence)

Hp = vaginal intercourse w/o ejaculation on 11\textsuperscript{th} June
Hd = vaginal intercourse with ejaculation on 3\textsuperscript{rd} June

Expectations of finding semen from S on V vaginal swabs taken on the 12\textsuperscript{th} June is approaching zero for both Hp and Hd (very low expectations)

LR = 0.0000000001/0.0000000001 = 1

If LR same given Hp and Hd is there any point in examining?
Expectation of finding V DNA on S penile swabs?

Hp = vaginal intercourse on 11\textsuperscript{th} June
Hd = vaginal intercourse on 3\textsuperscript{rd} June

Swabs taken 15 hrs later – not washed, V not menstruating, no recent intercourse (other than incident)
Hp = 0.8 (moderately high expectations)

Swabs taken 9 days later – no recent contact
Hd = 0.000000000000001 (very low expectations)

LR = 0.8/ 0.000000000000001 = 8000000000000000
If V DNA found on S penile swabs then the findings are 8000000000000000 more likely given Hp rather than Hd

Extremely strong support for Hp rather than Hd
Strategy

• Examine penile swabs 1st
• If V DNA present – good result could stop here

• If V DNA not present consider
  – examination of S underwear
  – examination of vaginal swabs
    • Semen
    • Y-STR’s

LGC Classification: PROTECT
Thank you for listening

Questions???